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VOL. XXVII.]
No. 665.]

AUGUST 22, 1890.

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THE ELECTRICAL REVIEW

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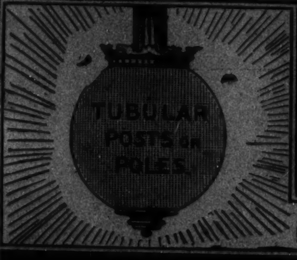
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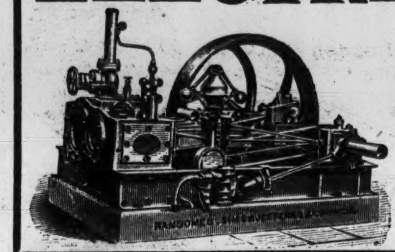
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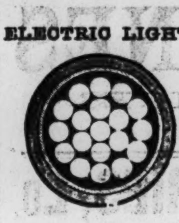

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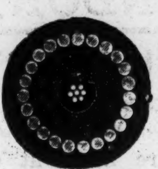

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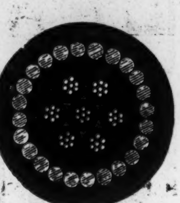

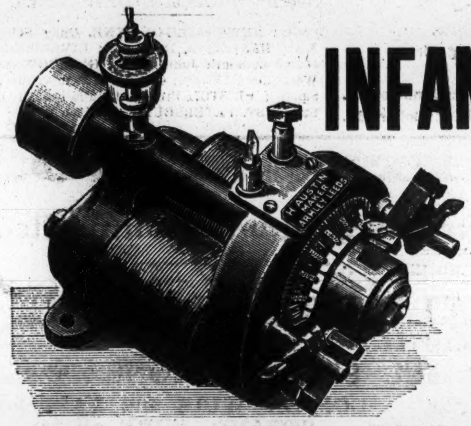

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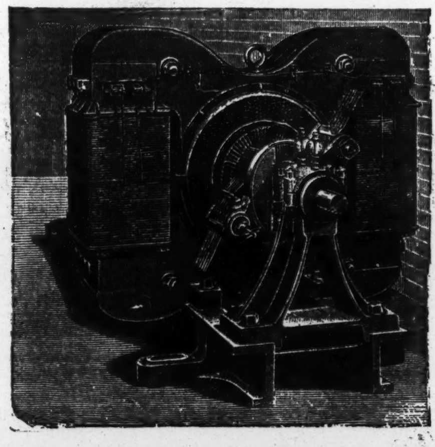

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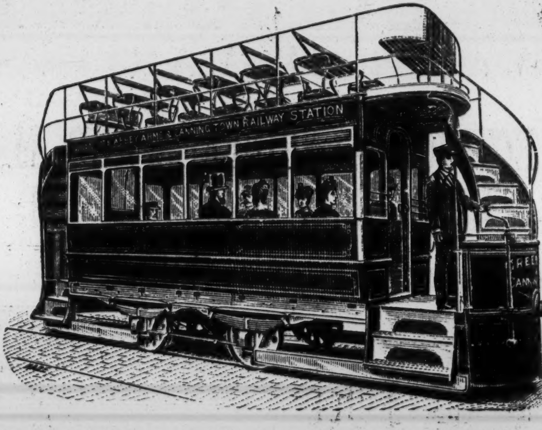

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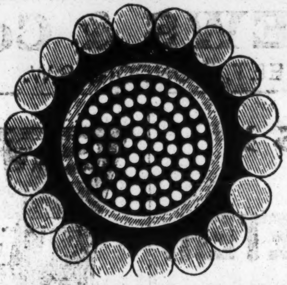

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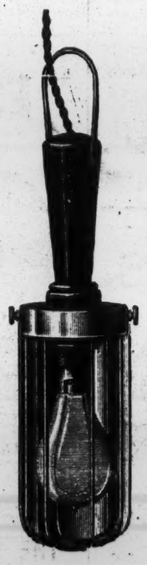

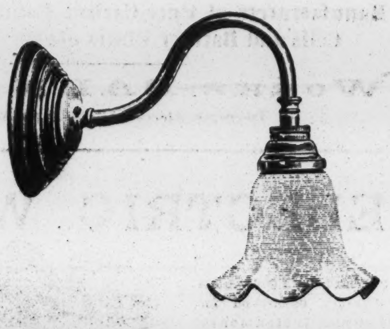

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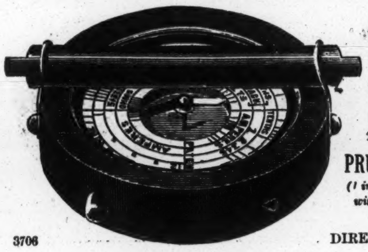

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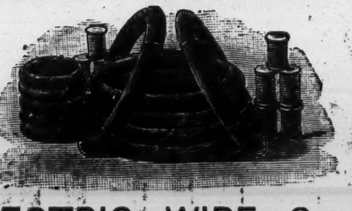

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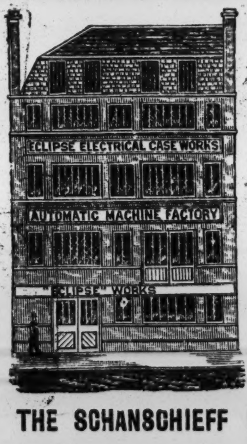

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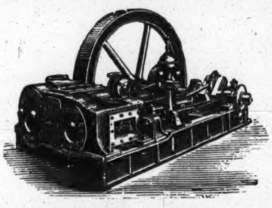

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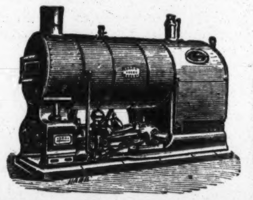

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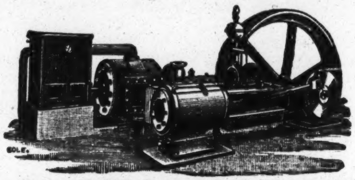

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THE TELEGRAPHIC JOURNAL AND

ELECTRICAL REVIEW.

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M. GRAMME.

IN the report presented by the Comité des Arts Economiques to the Société d'Encouragement pour l'Industrie Nationale, in which M. Gramme's title to be awarded the Grande Medaille d'Ampère is set forth, M. Mascart reminds the committee that it is to Pixii, under Ampère's guidance, that we owe the first machine which has enabled us to dispense with chemical combinations in obtaining electrical currents. Thereafter the chief difficulty was to manipulate the natural alternation of these currents, so as to give them a like direction in the exterior circuit. Except in certain particular applications, arc lighting, for instance, where the inverse direction of the currents presented no inconvenience, the difficulty appeared to be insuperable. We can understand, therefore, the revolution that took place when, in 1869, M. Gramme invented his machine. It may be said that, for Paccinotti, the discovery existed in principle already, but, if so, this must have been unknown not merely to Gramme, but also to the scientific world, or how account for the astonishment which Gramme's discovery evoked? It must be borne in mind also that the feeling among competent persons was not altogether of a nature to encourage a comparatively unknown inventor, for it must be remembered that Gramme, who was then a simple workman, had but lately arrived in Paris, knowing merely how to read, write, and cipher, in addition to having some ideas of design picked up at odd moments. The best judges proved shortsighted in this case—even Breguet, who had received the inventor with his customary kindness, and defrayed the cost of patenting the invention, could hold out no hopes as to the future of the invention. Ten years later, at the International Exhibition of 1881, there was not a machine of old or new-world construction that had not its Gramme ring, and it is due to M. Gramme that Frenchmen are able to boast that the first alternating current machine and the first continuous current machine were both constructed in France. It is these immense services rendered to the industry in general, and particularly in France, that the society desires to honour, and to this effect it has been decided to award to M. Gramme a special medal bearing the effigy of Ampère, thus at the same time rendering homage to the immortal creator of electro-dynamics.

M. FERDINAND CARRÉ.

GENERAL SEBERT, in presenting the report of the Comité des Arts Economiques to the Société d'Encouragement pour l'Industrie Nationale, in which M. Ferdinand Carré's claims to the Henry Giffard prize of 6,000 francs for the most signal services rendered to French industry are set forth, observed that M. Carré's investigations in the artificial production of cold, and the manufacture of carbons for use in electric lighting, had had considerable influence on the industrial world. It was owing to M. Carré's investigations under the latter head that certain recent developments in electric lighting had been possible. The manufacture of carbons for electric lighting was at first by means of Foucault's method of pointing the carbons, a method capable only of producing an irregular and expensive article. That was in 1868. It was then that M. Carré, in a note addressed to the Academie des Sciences, pointed out a process by which some of the drawbacks of the Foucault process could be avoided. In 1876 he patented his draw-plate method, to which he subsequently added improvements with a view to securing regularity and excellence. These improvements included the composition of a carbonaceous paste and the choice of an adhesive liquid as well as ingenious processes for the burning, drying, and the impregnating of carbons under heat, by means of vacuum and compression; and it is due to them that the use of Jablochkoff candles has been possible. The sale of drawn carbons has been considerable from the outset. With a view to modify the tint of the arc and to get rid of the incandescent particles projecting from the superficial strata, M. Carré first devised a hollow carbon furnished with a core of different composition, next a process whereby the carbons were impregnated with various salts subsequently removed from the outer layers by solution, so that only the core remained impregnated. These improvements he patented in 1878 and 1886. He also succeeded in producing a carbon to give out a red light. The fluted carbon, which is largely used in England, and was the subject of a patent in 1886, we also owe to M. Carré. Unfortunately, owing to these inventions not having been patented abroad, they are used without let or hindrance in foreign countries, and the inventor's profits are consequently greatly curtailed. But the services of M. Carré are freely acknowledged; and, in awarding the Giffard prize to him, the society is acting in accordance with the popular verdict.

HOIST WITH HIS OWN PETARD.

"A GOOD letter has laid the foundation of many a man's prosperity." If there is any truth in this maxim, then, a correspondent, whom we assume to be very youthful, and whose communication upon cable-testing appears in another column, commences life with a good augury for his future career.

We need not refer to the *raison d'être* of Mr. Hall's letter, for it explains itself. The characteristics of such compilations as his should be conciseness and perspicuity, and on these points the gentleman, whose wrath we have incurred, is strong indeed; with the exception of a few terms of compliment, not a superfluous word should be admitted, and in this respect our correspondent is rigorously exact; indeed, the composition may be characterised as one of those efforts of polite letter-writing, in which all words not absolutely indispensable are omitted, giving rise to a forcible style, in which will be found all the essentials of true elegance.

While regretting that we do not number Mr. H. Cuthbert Hall amongst our regular readers, we can still congratulate our contemporary, whose devotion to submarine cable interests is supposed to be the sole object of its existence, upon having secured a contributor of such originality in research, and upon whose broad shoulders the mantle of Faraday is evidently destined to fall.

In reality, the matter at issue is so simple, old, and utterly unimportant, that we should not have entered into any discussion except out of sheer good nature to Mr. Hall, whose error in this respect, might, on some future occasion, lead him into one still greater if his vapourings were not checked with a firm hand and good intent withal. Why our correspondent should characterise the simple statement that his device is old, as unscientific criticism, is best known to himself. Moreover, that assertion is not argument, nor inaccurate statement, proof, are truisms not unknown to us, but in how much our remarks justify Mr. Hall's reminder can best be seen by the appendices to his letter.

Probably after a perusal of these, Mr. Hall will regret having sent us a communication which can scarcely be said to comply with the precept,

> "Adopt with every man the style and tone
> Most courteous, most congenial with his own."

unless, indeed, he is utterly devoid of sentiment of this nature.

It remains now to be seen whether, after our acceptance of the challenge thrown out by him, and the complete vindication of our statement that the method of cable testing he described is neither novel nor interesting, he will have the manliness to apologise for his hasty and ill-advised epistle.

THE PETROLEUM ENGINE COMPANY, LIMITED.

THE company formed in 1888, for the development of the petroleum engine industry, by the manufacture of engines under the patents of Etéve, Hume and Priestman, for the United Kingdom and the British Colonies, including Canada and India, has just issued its annual report. It appears that the royalties received show a steady progression from £18 in 1888, to £559 and £1,035 in 1889 and 1890 respectively, and out of these amounts the directors' fees (£400) and other expenses of management, together £605 *per annum*, have to be deducted. At this rate, another three or four years will probably be passed before a modest 5 per cent. can be received by the shareholders, and it seems a convenient opportunity to now consider whether some changes cannot be made which shall tend to the return of the capital expended as the lives of the patents expire, and also to a reasonable interest on it during that period.

The utility of the engines has been amply demonstrated for many purposes, such as electric lighting, chaff cutting and threshing, driving lathes and tools, pumping, driving dairy and bread making machines, &c. In regard to the use in conjunction with dynamo machines, we have always had a high opinion of the engine's merits, and as the company possesses many first-class testimonials from practical and well known users, the difficulties incidental to the introduction of a new engine should by this time have disappeared.

The fees of the directors, £100 each, we think should be voluntarily reduced, seeing that the management is of an almost nominal character, Messrs. Priestman Bros. having not only the manufacture but the sale of the engines also, mainly in their hands.

It would be very interesting to know how much Messrs. Ernest Scott and Co., the second firm licenced, have done, what amount of royalties has accrued from their manufacture, and if but little (for we see no mention of their name in this year's report), why it is so. Have they had all facilities for making engines of the latest patterns, and if not, why not?

It seems likewise desirable that the petroleum engines should be well pushed in the colonies and India; are they being introduced there with all the energy and tact that can be brought to bear upon the business?

The directors have a really good thing to manage, and if those who now manufacture cannot go ahead faster, surely others can be found to undertake the work, so that the shareholders may soon have an opportunity of getting for their outlay at least some interest thereon.

Localising Faults in Insulated Wires.

AT Silvertown, the insulated trough method of localizing faults is no longer in use. It was found that when the core was covered with any fibrous material, the passing of it through a trough of water was too slow a process, as, unless the fault was a very decided one, it was necessary to proceed slowly, to allow the covering to get soaked. Mr. Hawkins has used a method which is as follows:—The core to be examined has one end sealed; beginning with this end it was wound on a drum which revolved *in* a trough of water, the latter being to earth. The other drum from which the core was being *unwound* had a hole through the side, through which the end of the core protruded, and was fastened by a screw to a brass or copper disc carried by an ebonite collar fitting on to the drum spindle. Contact was made by a spring which pressed against the periphery of the revolving disc, the other end of the spring having a lead to battery and galvanometer. Mr. Hawkins found that the drum upon which the cable was wound being in water, there was no fear of having the fibre insufficiently soaked. At Siemens's works the method devised by their electrician, Mr. F. Jacob, and described in Kempe's Handbook, has been in use some 15 years. The whole point of the method lies in having the external coating of every portion *to earth*, except that which is connected through the galvanometer to earth; thus the resistance along the outside of the wet core being considerably higher than the resistance of the galvanometer, any current through the fault in the portion connected to the galvanometer goes mostly through that instrument, whereas if the other portion is only on insulated drums, and the outside of the core is not perfectly insulated between that and the portion connected to the galvanometer, any small fault is most difficult to localise.

The P. M. G.'s Progress.

MR. RAIKES has caused questions to be asked by circular letter of those having registered telegraph addresses: 1st, as to whether the addressee has any objection to the publication of his registered address. 2nd, as to whether, if a list were published (of addresses in London), the addressee would wish to have a copy, the fee for registration, together with a quarterly copy of the list, being two guineas a-year. The idea of issuing a list seems to be a very good one, but to be thoroughly useful it should be extended to the whole of Great Britain—*i.e.*, all telegraph addresses in the United Kingdom should be brought into one list. This list, we think, need only be issued annually, and in that case it might be found possible to bring it out for the extra guinea to be charged beyond the usual guinea for the registration. For a list of London addresses only we consider a guinea by far too high a price. We do not know what number of registered addresses there may be in the whole of Great Britain, but this may be said safely that the greater the number the larger would be the demand for the list, and consequently the cheaper should be the relative cost of its production.

The Need for a Pacific Cable.

THE Melbourne *Evening Standard* of July 14th, 1890, has a somewhat lengthy article on the subject of the Pacific cable, and, having pointed out the various disadvantages of other routes, says:—"Against these many disadvantages the Pacific route offers a security in that throughout its entire length—across Canada from Vancouver to Hawaii, Fanning Island, Samoa and New Zealand—it would only touch foreign territory at Honolulu and Tutuila, while, as experience has abundantly proved, the greater depth at which the cable would lie would render it less liable to injury through volcanic disturbance, besides giving it greater protection against any hostile attempt at severance. In recognition of the advantages which the enterprise of the Eastern Extension Company has secured to Australia, Sir John Pender should be dealt with in a fair and liberal spirit. But it should not be forgotten that the benefit has been mutual, and that the Australian share would be terribly discounted if, by losing interest in the Pacific cable, it were to sacrifice its safety." We are glad to see the Melbourne Press fully alive to the true interests of the Colonies in the above matter, and sincerely trust that through such means the public opinion of Canada, Australia and New Zealand may be guided to the successful carrying out of this absolutely necessary enterprise.

Telegraph Poles for Advertising Purposes.

A MELBOURNE (Australia) paper says "there is every reason to believe that an arrangement will be entered into whereby the present unsightly wooden poles which support the street telegraph wires will be transformed into advertising hoardings, with due regard to the æsthetic cravings of the pedestrians. It is claimed that no damage will be done to the property of the Post Office, and that while the City Council will take proper precautions to prevent the impeding of traffic, the advertising company will substitute symphonies in gold, pink, and azure for the black tar besmirched posts, whose ugliness is but hardly excused even on utilitarian grounds." On reading the first few lines we were struck with horror to think what such a similar arrangement might do for our English towns, for although it is conceivable that harmonious designs by Burne Jones, Edward Poynter, Walter Crane, Whistler and others might prove interesting, nay, even instructive to art lovers among the public, yet we fear that in but too many cases colour and form would be sacrificed to giving prominence to the commercial aspects of the announcements. Telegraph poles, at any time, appear as defects in a landscape, but transformed into "advertisement hoardings" they would be simply atrocious, unbearable. Happily, however, there is not much fear that our Postal Department would be a party to such an arrangement as that indicated above, even though importuned to be so.

FRANKLAND'S RESEARCHES ON THE CHEMISTRY OF STORAGE BATTERIES.

THE chemical changes which take place during the charging and discharging of storage batteries have been the subject of considerable difference of opinion amongst chemists and physicists. Some authorities have maintained that the effects are dependent on the occlusion of oxygen and hydrogen gases on the plates, whilst others, regarding the question from another point of view, have held that lead sulphate plays an important part in the phenomena. That the differences of opinion amongst experts have been widely divergent may be recognised from the fact that scientists, who, apparently, are well competent to express their views, have asserted that no chemical change of the lead sulphate occurs either in the charging or discharging of the plates.

In order to test the accuracy of the former opinion, Dr. Frankland, some time ago, undertook a series of experiments, the results of which were communicated to the Royal Society (*vide* Proceedings Royal Society, XXXV., p. 67). Two plates of lead were twisted into a corkscrew form, the gutter of the screw being filled with red lead; these plates were immersed in dilute sulphuric acid and charged in the usual way. When these plates were subsequently heated and the gas evolved, collected and examined, it was found that mere traces of oxygen and hydrogen were expelled, whereas, if the theory had been correct, there should have been a copious evolution. Hence, it was concluded, that the important agent in the cell is not constituted by the occluded gases.

With regard to the lead sulphate, Dr. Frankland observed that in charging a strong cell, a considerable amount of sulphuric acid disappears, and is accompanied by a certain deposition of lead sulphate, but that the deposit formed is inadequate to account for the total acid which has disappeared.

The strength of the acid ceases to diminish and afterwards increases as the charging of the cell proceeds; this change continues until the maximum charge has been reached, and oxygen and hydrogen gases are evolved from the positive and negative plates respectively.

When the cell is discharged, the phenomena above described are reversed, the specific gravity of the acid decreasing from the point from which it began to increase on the charging of the cell.

From these experiments and the observations made upon them, Dr. Frankland deduced the following results, representing the changes which occur in *charging* a storage battery, viz.:

1. The electrolysis of hexabasic sulphuric acid (*i.e.*, $H_6\,SO_6$) according to the equation

$$H_6\,SO_6 = \underbrace{SO_3 + 3O}_{\text{on + plate}} + \underbrace{3\,H_2}_{\text{on − plate}}$$

2. The reconversion of the evolved sulphuric anhydride (SO_3) into the corresponding acid ($H_2\,SO_4$).

3. Chemical action on the coating of the positive plate according to the equation

$$PbSO_4 + O + 3\,H_2O = PbO_2 + H_6\,SO_6.$$

4. Chemical action on the coating of the negative plate according to the equation

$$PbSO_4 + H_2 + 2\,H_2O = Pb + H_6SO_6.$$

When the storage battery is *discharged*, the first two changes observed in charging the battery are repeated. Further, on the coating of the positive, formerly the negative electrode, the chemical change which takes place is represented by the equation

$$PbO_2 + H_2 = PbO + H_2\,O$$

on the coating of the negative. Finally, the positive electrode, the change occurring is represented by the equation

$$Pb + O + H_6\,SO_6 = Pb\,SO_4 + 3\,H_2\,O.$$

Hence Dr. Frankland formed the opinion that the formation of the cell consists in the more or less thorough decomposition of those portions of the lead sulphate comparatively removed from the conducting metallic nucleus of the lead. Lead sulphate possesses a low specific conducting power, whilst lead peroxide, and especially spongy lead, offer comparatively little resistance to the current, which is thus enabled to bring the outlying portions of the coating under its influence.

Since these results were published, Dr. Frankland has been pursuing his researches in the same direction. He undertook a series of experiments with a view to ascertaining what lead compounds actually take part in the chemical reaction in charging and then discharging secondary batteries.

A quantity of lead oxide (PbO_2) reduced to a fine powder was treated successively with portions of dilute sulphuric acid until the liquid became permanently acid. On being allowed to stand, a buff-coloured precipitate separated from the mixture and was found by analysis to possess the formula $Pb_5\;S_3\;O_{14}$.

When finely powdered red lead ($Pb_3\,O_4$) was treated in the same way with dilute sulphuric acid, the powder which settled on standing was brownish-red in colour, and was found on analysis to have the constitution $Pb_3\,S_2\,O_{10}$.

Dr. Frankland considers that these hitherto unknown or undescribed salts constitute the original active material of storage cells, and that the following equations accurately represent the reactions which take place on the surface of the plates on charging and discharging the battery.

A. If the buff-coloured salt is the active material used, then

I. on charging—

(1) Positive plate, $Pb_5\,S_3\,O_{14} + 3\,H_2\,O + 5\,O = 5\,PbO_2 + 3H_2\,SO_4$.

(2) Negative plate, $Pb_5\,S_3\,O_{14} + 5\,H_2\,O = 5\,Pb + 3\,H_2\,SO_4 + 2\,H_2\,O$.

II. on discharging—

(1) Positive plate, $5\,PbO_2 + 3\,H_2\,SO_4 + 5\,H_2 = Pb_5\,S_3\,O_{14} + 8\,H_2\,O$.

(2) Negative plate, $5\,Pb + 3\,H_2\,SO_4 + 5\,O = Pb_5\,S_3\,O_{14} + 3\,H_2\,O$.

B. If the brownish-red coloured salt is the active material used, then

I. on charging—

(1) Positive plate, $2\,Pb_3\,S_2\,O_{10} + 2\,O_2 + 4\,H_2\,O = 6\,PbO_2 + 4\,H_2\,SO_4$.

(2) Negative plate, $Pb_3\,S_2\,O_{10} + 4\,H_2 = 3\,Pb + 2\,H_2\,SO_4 + 2\,H_2\,O$.

II. on discharging—

(1) Positive plate, $6\,PbO_2 + 4\,H_2\,SO_4 + 4\,H_2 = 2\,Pb_3\,S_2\,O_{10} + 8\,H_2\,O$.

(2) Negative plate, $3\,Pb + 2\,H_2\,SO_4 + 2O_2 = Pb_3\,S_2\,O_{10} + 2\,H_2\,O$.

It is worthy of remark that in practice, only half as much material seems to be necessary for the negative as for the positive plates, and this is evidence in favour of the latter alternative, B, being correct.

We cannot assume, however, that there is nothing more to be discovered concerning the chemical action of storage batteries. The subject is full of complications, and it is to be hoped that electricians will receive further and large assistance from chemists who alone, perhaps, are able to throw the necessary light upon these obscure matters.

EDINBURGH EXHIBITION.

(*Continued from page* 126.)

The Barothermotelemeter.—With Mr. Johnston Stephen, of Edinburgh, the Lord Justice Clerk is joint inventor of this instrument. It is for the purpose of enabling observers to take readings as often as desired, and by a single wire, from barometers and thermometers placed at great heights or distances, without the necessity of the observer being resident where the instruments are placed, thereby saving much expense, and enabling observations to be taken at points where residence might be impossible. The barometer has inserted in its mercury a rod of insulating material, on which a screw thread has been cut, and on this thread a fine wire is wound. An electric circuit, established through this coiled wire to the mercury, and by a conductor from the mercury to earth, will, of course, meet with more or less resistance, according to the height of the barometer, as the coils are more or less short-circuited by the mercury. The thermometer has two carbon threads passed down into the mercury, and in the same way as in the case of the barometer the resistance is increased or reduced by the fall or rise of the mercury lengthening or shortening the circuit through the carbon threads. The procedure by the observer at a receiving station consists in taking, first, a reading of the line resistance, without passing the current through the instruments, then passing the current through the instruments in succession, and taking readings, correcting these by the reading of the line wire. The mode in which these changes are accomplished is shown in fig. 1. The flat coil, A, B, is balanced on the pivot, E, and the permanent fixed magnet, F, G, rests within the coil. On the circular disc, to which A, B is attached, a curved tube, C, D, is placed, which has a metal plate along its lower side, and a small quantity of mercury (shown by the shading).

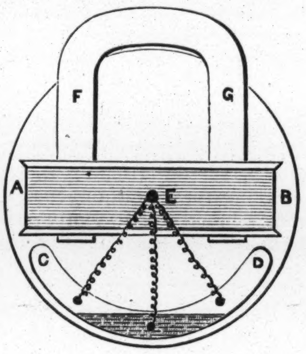

FIG. 1.

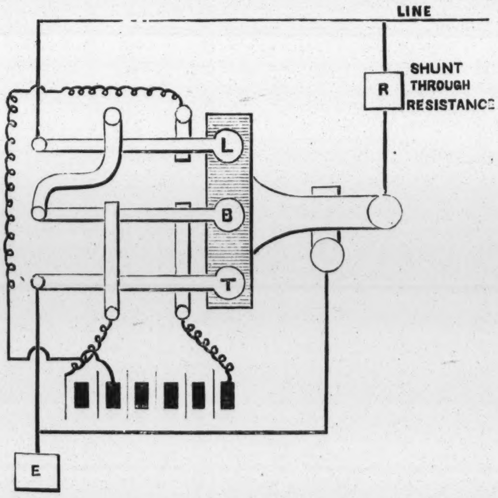

FIG. 2.

Three wires are inserted in the upper side of the tube—one in the centre, and one near each end. When the tube, C, D, is at rest a weak current passed from the line through the centre wire will not disturb the position of C, D. The line resistance can thus be noted. If a strong + current be then passed, C, D is moved so that the mercury leaves the centre wire and makes contact with one of the side wires, and thus shunts the circuit from the line through the barometer circuit, the resistance of which is then checked. The thermometer is then checked by passing a strong − current, which turns C, D in the opposite direction, and makes the circuit through the other side wire. The mode in which these switchings are accomplished at the observing station is shown in fig. 2. It will be seen that when the key, L, is used a weak current passes to line, when the key, B, is used a strong + current passes, and when the key, T, is used a strong − current passes. In each case, when the key is still further depressed, it gives the current an alternative path through a bridge and proportional coils, thus enabling the readings of the resistance to be taken. The upper side of the large key, which connects the rheostat, is covered with insulating material to prevent short-circuiting.

A NEW FORM OF GAS BATTERY.

AT one of the meetings of the Royal Society, a short time ago, a new form of gas battery was described by Messrs. Ludwig Mond & C. Langer. There are several forms of gas battery already known, but the peculiarity of this latest modification is that it is a *dry* gas battery.

The new battery may be thus briefly described :—A diaphragm of some porous non-conducting material, such, for example, as plaster of Paris, is saturated with dilute sulphuric acid, or with some other common and suitable electrolyte. This diaphragm is covered on both sides with thin platinum foil, which has been finely punctured, and which contains about 1,500 perforations per square centimetre. The foil is overlaid in its turn by a thin film of platinum black.

The internal resistance is reduced to a minimum by placing the foil in contact at short intervals with strips of some good conductor.

A number of such diaphragms having been prepared in the manner described, they are placed side by side, or one above the other, with non-conducting frames intervening ; this arrangement forms chambers through which the gases employed are passed. One side of each diaphragm is exposed to the action of air or hydrogen, whilst the alternate sides are exposed to the action of hydrogen gas, and the spaces which exist between the diaphragm are so connected that the gases pass through the whole series each in its own proper way.

Experiments were made in order to estimate the electromotive force of such a battery as this, with the result that it (the E.M.F.) was found to vary considerably with the quality of the platinum black.

The best result obtained was :

$$\text{E.M.F.} = 0{\cdot}97 \text{ volt},$$

and this was yielded when platinum black, prepared as follows, was employed, namely, by precipitation from a boiling solution of platinum tetrachloride by neutralising with sodium carbonate, and afterwards reducing with a boiling solution of sodium formate.

The resistance of a plate of plaster of Paris, 8 mm. in thickness and having 350 sq. cm. of surface, was found to be

$$\text{R} = 0{\cdot}02 \text{ ohm}.$$

The maximum amount of work was obtained from this battery when the external resistance was nearly double the value of the internal resistance.

After much experiment it was found most convenient to work the battery with an electromotive force of about 0·73 volt, which allows a current of from 2·0 to 2·5 ampères to be taken out of an element with 700 sq. cm. of active surface covered with 0·35 gramme of platinum foil and 1 gramme of platinum black. The temperature should be maintained constant at 40° C. by passing excess of air through the battery.

About one-half of the energy of combustion of the hydrogen gas is converted into electrical energy ; this is, comparatively speaking, a high value.

Messrs. Mond and Langer, besides experimenting with oxygen and hydrogen, also tried air and a gas containing from 30 to 40 per cent. of hydrogen—a gas, in fact, such as can be got by the action of steam, with or without air, on coal or coke.

As might be predicted, this battery after having been at work for some time begins to exhibit signs of polarisation. In the opinion of Messrs. Mond and Langer, this phenomenon is caused by a charge in the concentration of the acid at the two electrodes, and may be remedied by interchanging the gases from time to time ; this can be effected with the greatest ease since the materials to be interchanged are gaseous.

It is only fair to remark, in conclusion, that Messrs. C. R. A. Wright and C. Thompson have recently stated that the gas battery described by Messrs. Mond and Langer is practically identical in principle with one described by them in 1888 in a paper entitled "On the Development of Voltaic Electricity by Atmospheric Oxidation" (*vide Proceedings Royal Society*, Vol. XLIV., p. 182), and which was perhaps foreshadowed in a previous paper by them, entitled "Note on the Development of Voltaic Electricity by Atmospheric Oxidation" (*vide Proceedings Royal Society*, Vol. XLII., p. 212.)

A SYNTHETIC STUDY OF DYNAMO MACHINES.

(*Continued from page* 40.)

IX.—THE HEATING OF MACHINES.

IN every dynamo there is performed internally while running a certain amount of work, first, in forcing the current through conductors having some resistance; secondly, in continually changing the direction of the magnetism in the armature core ; thirdly, in generating in the latter feeble parasitic currents. The energy thus dissipated appears in the form of heat ; accordingly the machine increases in temperature from the time it is started, and attaining a maximum when the rate of losing heat into the surrounding air is exactly equal to the rate at which it is generated in the machine. There is also, in addition to the above, some work done in overcoming the friction of the journals. As this need be no greater than in other machinery through which at the same speed similar power is transmitted, the heating arising therefrom calls for no special attention.

In fixing the heating limits, two things must be borne in mind. First, the temperature must not be great enough to cause deterioration of the insulating material ; secondly, the variation must not be great enough to give trouble from the expansion and contraction of the metal parts. As regards the armature, there is some difficulty in measuring the actual temperature of the conductors. As a rule, they are covered all round with insulating material, and the usual way being to lay the thermometer on the insulation when the machine stops running, what is actually observed is, of course, the temperature attained by the outside covering. On the other hand, what we actually take the indication from is of little importance, provided the observation affords a guide as to whether the temperature of any part gets too great. It is certain that the wires next the core, in an armature wound with, say, four layers of ·048 inch diameter wire, would be a good deal hotter than would be indicated immediately by a thermometer placed on the covering of the outer wires when the machine stops. At the same time if we know from experience, that the heating of the inside wires is harmless when the temperature of the outside covering does not with the thermometer left on exceed a certain amount, an observation of the outside temperature should furnish us with a perfectly reliable guide as to what cooling surface should be allowed. In practice we can only measure the surface temperature, and, given a certain rate of generating heat, the temperature which the surface attains in running depends upon its extent and character, and on the speed of rotation. But the difference of temperature between the interior and the outside depends upon the thermal resistance encountered by the heat in flowing to the surface. In an armature wound with one layer of coarse wire, for example, it would require less difference of temperature to produce a given flow of heat than in one wound with several layers of fine wire. In the former there is only one layer of cotton insulation for the heat generated in the copper to flow through, while in the latter the flow to the surface takes place partly by conduction round and round the fine wire and partly through the several layers of badly conducting cotton covering. But by leaving the thermometer on the machine, and noting the maximum to which it rises, we can readily obtain an idea of the temperature to which the underneath insulation is subjected.

The interior of the core is always hotter than the underneath layers of wire, even if the heat generated in the iron itself is small. When the armature is built of plates the difference in temperature between the interior and exterior of the core is little, as the iron forms a continuous conductor which carries off the heat fairly well ; but if constructed of iron wire the difference is greater, as the flow of heat is obstructed by badly-conducting substances (cotton covering, varnish, &c.). When a machine is started the heat flows from the copper into the surrounding air also into the iron core, the latter being for a time the cooler. As the run continues the core increases in temperature from this reception of heat, also on account of a certain amount being generated in its own mass. Its temperature becomes in time equal to that of the adjacent conductor, when it neither receives nor loses heat. Finally, it rises above that of the conductor by an amount just sufficient to cause its heat to flow outwards through intervening substances.

It will be seen, then, that the maximum temperature may not be attained for a considerable time, as, due to the absorption of heat by the core, the cooling surface is virtually large to start with, but gets less and less as the core attains its maximum. When the ultimate temperature is reached, the heat is radiated from the exterior surface only, and the heat thus radiated is exactly equal to the heat generated. The time it takes for the machine to reach its ultimate temperature varies considerably, as might be expected. Very often the maximum temperature is not attained in large machines until they have run for six or eight hours, while in smaller machines a two to three hours' run may be sufficient. For a thorough test, the machine should be run with full load until its temperature ceases to rise.

Some difference of opinion exists with reference to the temperature which should be permitted. The British Admiralty allow a rise of about 40° C. above the surrounding atmosphere, and engineers are generally specifying this limit for the contracts of which they have charge. The measurement is taken by placing the thermometer on the armature after the machine has stopped, and noting the maximum attained. It thus indicates something less than the actual temperature of the core and conductors, but affords a reliable enough indication as to whether the heating in these is too great. If the rise measured in this way does not exceed 40° C., the insulating material is considered to be in no danger of deterioration.

Remembering that the Admiralty dynamos have often to work in an atmosphere of some 50° C., this rise seems somewhat ample, while for land dynamos, working under ordinary conditions, it does very well. Mr. Esson, in his recent paper, stated as his opinion that in no case should the maximum temperature exceed 75° C. *i.e.*, the temperature of the room added to the rise in continuous running. In the continuous running of an

Edison-Hopkinson dynamo for three weeks at full load the temperature of the armature varied from 76° C. to 84° C., keeping throughout the run about 60° above the surrounding air. In America they work much hotter, and accordingly we find the United Edison Manufacturing Company specifying that after a 10 hours' run at full load no conductor or other electric part of their dynamos shall have a temperature of more than 80° C. above the surrounding atmosphere. This, to British electricians, seems excessive, though the reflection that the American limit is not exceeded may, at times, comfort them, when, for some unforeseen reason, a machine runs hotter than usual. Speaking generally, a temperature limit of 75° C., which includes a rise of from 30° to 40° C., is not exceeded by the best English practice.

(*To be continued.*)

TESLA'S NEW ALTERNATING MOTORS.[*]

FOR some time past Mr. Nikola Tesla, whose previous work in alternating current motors is well known, has been engaged upon the study of these machines, in order to develop efficient methods for operating them on two wires instead of three, and still without the use of a commutator.

The general principle upon which these machines are designed is based on the well-known fact that if a magnetic core, even if laminated, be wound with a coil, and a current be sent through, the magnetisation of the entire core does not immeditely ensue, the magnetising effect not being exhibited in all parts simultaneously. This Mr. Tesla attributes to the fact that the action of the current is to energise first those laminæ or parts of the core nearest the surface and adjacent to the exciting coil, and from thence the action progresses towards the interior. A certain interval of time, therefore, elapses between the manifestation of magnetism in the external and the internal sections or layers of the core.

If the core be thin or of small mass, this effect may be inappreciable, but in the case of a thick core, or even of a comparatively thin one, if the number of alternation be very great, the time interval occurring between the manifestations of magnetism in the interior of the core and in those parts adjacent to the coil is more marked, and in the construction of such apparatus as motors which are designed to be run by alternating currents, Mr. Tesla has found it desirable, and even necessary, to give due consideration to this phenomenon and to make special provisions in order to obviate its consequences.

On the other hand, by taking advantage of this very action or effect, and, by rendering it more pronounced, Mr. Tesla utilises it in the operation of motors in general. This he effects by constructing a field in which the parts of the core that exhibit at different intervals of time the magnetic effect imparted to them by alternating currents in an energising coil are so placed with relation to a rotating armature as to exert thereon their attractive effect successively in the order of their magnetisation. By this means there is secured a result similar to that which Mr. Tesla has heretofore attained in the previous types of his motor, in which, by means of one or more alternating currents, he produces a rotation or progression of the magnetic poles or points of maximum attraction of the field of force.

The general principle involved in the action above mentioned is illustrated in the simple motor shown in fig. 1. Here X represents a large iron core composed of a number of sheets or laminæ of soft iron or steel. Surrounding this core is a coil, Y, which is connected with a source, E, of rapidly varying currents.

Let us consider now the magnetic conditions existing in this core at any point, as *b*, at or near the centre, and any other point, as *a*, nearer the surface. According to Mr. Tesla, when a current impulse is started in the magnetising coil, Y, the section, at *a*, being close to the coil, is immediately energised, while the section, at *b*, which, to use a convenient expression, is "protected" by the intervening sections or layers between *a* and *b*, does not at once exhibit its magnetism. However, as the magnetisation of *a* increases, *b* becomes also affected, reaching finally its maximum strength some time later than *a*. Upon the weakening of the current the magnetisation of *a* first diminishes, while *b* still exhibits its maximum strength, but the continued weakening of *a* is attended by a subsequent weakening of *b*. Assuming the current to be an alternating one, *a* will now be reversed, while *b* still continues of the polarity first imparted. This action continues, the magnetic condition of *b* following that of *a* in the manner above described.

If an armature, for instance, a simple disc mounted to rotate freely on an axis, be brought into proximity to the core, a movement of rotation will be imparted to the disc, the direction depending upon its position relatively to the core, the tendency being to turn the position of the disc nearest to the core from *a* to *b*, as indicated in fig. 1.

This action or principle of operation has been embodied in a practicable form of motor, which is illustrated in fig. 2. Here A represents a circular frame of iron, from diametrically opposite points of the interior of which the cores project.

Each core is composed of three main parts, B, B, and C, and they are similarly made with a straight portion, *e*, around which the energising coil is wound, a curved arm or extension, *c*, and an inwardly projecting pole, *d*.

Each core is made of two parts, B, B, with their polar extensions reaching in one direction and a part, C, between the other two and with its polar extension reaching in the opposite direction. These cores are wound with coils, D, which are connected in the same circuit either in parellel or series and supplied with an alternating current by a generator, E, represented diagramatically. Between the cores or their polar extensions is mounted an armature, F, wound with magnetising coils, G, that are closed upon themselves, similar to those in the older types of Mr. Tesla's motors.

The operation of the motor is as follows :—When a current impulse or alternation is sent through the coils, D, the sections, B, B, of the cores being on the surface, and in close proximity to the coils, are immediately energised. The sections, C, on the other hand, are protected from the magnetising influence of the coil by the interposed layers of iron, B, B.

As the magnetism of B, B increases, however, the sections, C, are also energised, but they do not attain their maximum strength until a certain time subsequent to the exhibition by the sections, B, B, of their maximum.

Upon the weakening of the current, the magnetic strength of B, B first diminishes while the sections, C, have still there maximum strength ; but as B, B continue to weaken, the interior sections are similarly weakened.

B, B may then begin to exhibit an opposite polarity, which is followed later by a similar change on C, and this action continues.

B, B and C may, therefore, be considered as separate field magnets, being extended so as to act on the armature in the most efficient positions, and the effect is similar to that in Mr. Tesla's other forms of motor, viz., a rotation or progression of the maximum points of the field of force. Any armature, such, for instance, as a disc mounted in this field, would rotate from the pole first, to exhibit its magnetism to that which exhibits it later.

In following out the ideas stated above, Mr. Tesla has applied them to a class of motors in which two or more sets of energising magnets are employed, and in which by artificial means a certain interval of time is made to elapse between the respective maximum or minimum periods of their magnetic attraction or effect. This has already been applied to the operation of Mr. Tesla's three-wire motors. In the present instance Mr. Tesla employs a motor with two sets of energising or field magnets, each wound with coils connected with a source of alternating currents, but forming two separate paths or circuits. The magnets of one set are protected to a certain extent from the energising action of the current by means of a magnetic shield or screen of laminated iron interposed between the magnet and its energising coil.

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[*] *Electrical Engineer.*

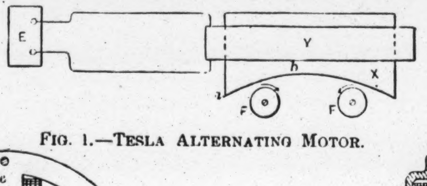


FIG. 1.—TESLA ALTERNATING MOTOR.

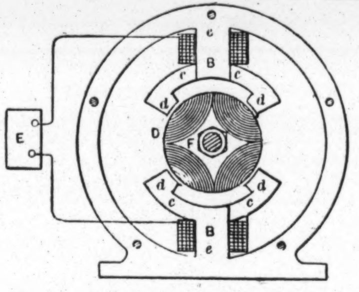


FIG. 2.—TESLA ALTERNATING MOTOR.

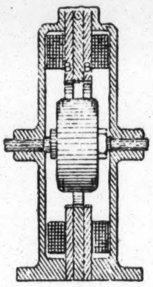


FIG. 3.—TESLA ALTERNATING MOTOR.

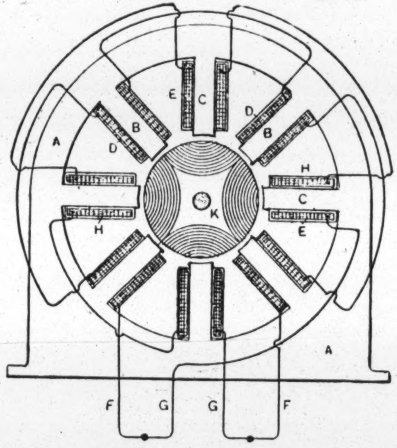


FIG. 4.—TESLA ALTERNATING MOTOR.

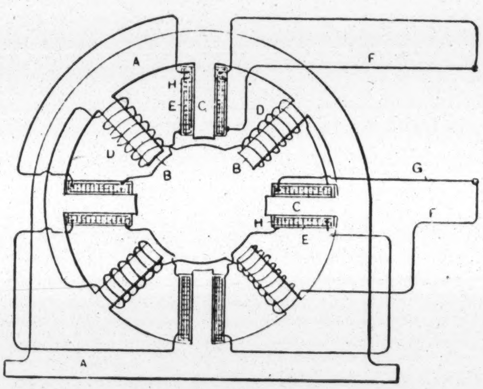
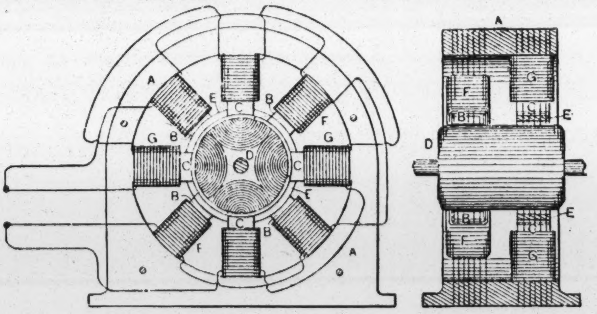


FIG. 5.—TESLA ALTERNATING MOTOR.



FIGS. 6 AND 7.—TESLA ALTERNATING MOTOR.

The shield is properly adapted to the conditions of particular cases so as to shield or protect the main core from magnetisation until it has become itself saturated, and no longer capable of containing all the lines of force produced by the current. By this means it will be seen that the energising action begins in the protected set of magnets, a certain arbitrarily determined period of time later than in the other, and that by this means a practically economical difference of magnetic phase may readily be secured.

The nature and operation of this motor will be readily understood by reference to the accompanying illustration.

The engraving, fig. 4, shows the simplest form of this type of machine. The cores, B, form one set of magnets, and are energised by coils, D, while the cores, C, forming the other set, are energised by coils, E, and the coils are connected in series with one another, in two derived or branched circuits, F, G, respectively.

Each coil, E, it will be noted, is surrounded by a magnetic shield, H, which is composed of an annealed insulated or oxidised iron wire wound on the coils in the manner indicated, so as to form a closed magnetic circuit around the coils, and between the same and the magnetic cores, C. Between the pole pieces or cores, B, C, is mounted the armature of the closed circuit coil type.

The operation resulting from this arrangement is as follows :—If a current impulse be directed through the two circuits of the motor, it will quickly energise the cores, B, but not so the cores, C, for the reason that in passing through the coils, E, there is encountered the influence of the closed magnetic circuits formed by the shields, H. The first effect is to effectively retard the current impulse in circuit, G, while at the same time the proportion of current which passes does not magnetise the cores, C, which are shielded or screened by the shields, H.

As the increasing electromotive force then urges more current through the coils, E, the iron wire, H, becomes magnetically saturated and incapable of carrying all the lines of force, and hence ceases to protect the cores, C, which become magnetised, developing their maximum effect after an interval of time subsequent to the similar manifestation of strength in the other set of magnets, the extent of which may be arbitrarily determined by the thickness of the shield, H, and other well-known conditions.

From the above it will be seen that the apparatus or device acts in two ways. First, by retarding the current, and second by retarding the magnetisation of one set of cores, from which its effectiveness will readily be seen.

Many modifications of the principle here embodied have been made by Mr. Tesla, one only more of which we may notice here. This is illustrated in fig. 5, and is similar in all respects to that above described, except that the iron wire, H, which is wrapped around the coils, E, is in this case connected in series with the coils, D. The iron wire coils are connected and wound so as to have little or no self-induction, and, being added to the resistance of the circuit, F, the action of the current in that circuit will be accelerated, while in the other circuit, G, it will be retarded.

Still another type of motor constructed by Mr. Tesla is one with a field magnet having two sets of poles or inwardly projecting cores, and placed side by side so as practically to form two fields of force, and alternately arranged, that is to say, with the poles of one set or field opposite the spaces between the other. The free ends of one set of poles are then connected by means of laminated iron bands or bridge pieces of considerably smaller cross-section than the cores themselves, so that the cores all form parts of complete magnetic circuits.

When the coils on each set of magnets are connected in multiple circuits from an alternating machine electromotive forces are set up in each circuit simultaneously, but the coils on the magnetically bridged or shunted cores will have, by reason of the closed magnetic circuits, a high self-induction which retards the current, permitting at the beginning of each impulse but little current to pass. On the other hand, no such opposition being encountered in the other set of coils, the current passes freely through them, magnetising the poles on which they are wound.

As soon, however, as the laminated bridges become saturated and incapable of carrying all the lines of force, which the rising electromotive force, and consequently *increased* current, produce, free poles are developed at the ends of the cores, which, acting in conjunction with the others, produce rotation of the armature.

The construction by which this is accomplished is shown in the accompanying engravings, figs. 6 and 7.

The frame of the motor, A, is built up of sheets of iron, punched out to the desired shape and bolted together with insulation between the sheets. When complete, the frame makes a field magnet with inwardly projecting pole-pieces, B and C. To adapt them to the requirements of this particular case, these pole-pieces are out of line with one another, those marked, B, surrounding one end of the armature, and the others, C, the opposite end, and they are arranged alternately; that is to say, the pole pieces of one are set in line with the spaces between those of the other sets.

The pole-pieces, C, are connected or shunted by bridge pieces, E.

The coils, F and G, are connected in series, respectively, in two circuits, which are branches of a circuit from an alternating machine, and they are so wound that the circuit of coils, G, will have a higher self-induction than the other circuit or branch.

The function of the shunts or bridges, E, is that they shall form with the cores, C, a closed magnetic circuit for a current up to a predetermined strength, so that when saturated by such current, and unable to carry more lines of force than such a current produces, they will, to no further appreciable extent, interfere with the development by a stronger current of free magnetic poles at the ends of the cores, C.

In such a motor, the current is so retarded in the coils, G, and the manifestation of the free magnetism in the poles, C, is delayed beyond the periods of maximum magnetic effect in poles, B. The result is that a strong torque is produced, and the motor operates with approximately the power developed in a motor of this kind, energised by independently generated currents, differing by a full quarter phase.

THE BREMEN ELECTRIC TRAMWAY.

As already announced in the REVIEW of the 11th ult., the first electric tramway in Europe on the Thomson-Houston system was opened in Bremen on the 22nd June. The length of the line, which forms a double track, except in one narrow street, is 1,748 yards, or nearly a mile. It commences at the Town Hall in the centre of the town and passing by the new railway station, terminates at Exhibition-place just inside the town park, where an industrial exhibition is now being held. The conductors, which are carried overhead, consist of copper wires 8·25 mm. in thickness, and are suspended from insulators attached to steel cables arranged transversely across the streets on steel and cast iron posts. The engine-house is situated about 220 yards from the starting point of the tramway and to the left side of the park entrance. It contains at present a Pétry-Déreux boiler, and a steam engine of 150 I.H.P., made by Küchen of Dusseldorf. This drives a dynamo having an output of 62,500 watts, at an E.M.F. of 500 volts at the terminals. There is also installed a 70 H.P. high speed Armington-Sims engine, and an arc light dynamo. Another dynamo, similar to the first, will shortly be erected. Current from this generating station is used for several purposes: for the working of the tramway; for operating a 15 H.P. electromotor placed in the Vienna Bakery in Exhibition-place, where the motor actuates several kneading machines, and a dynamo which supplies current to a number of arc and incandescent lamps; and for the lighting of many arc and glow lamps arranged on the tramway route, &c.

The current from the first dynamo goes from the positive brush to the main conductor, which is arranged at a height of 20 feet over the middle of the track and passes along it until it reaches a contact roller carried by the car. The current is collected by contact rollers, from which it passes to the two motors, then through the car wheels to the rails and thence back to the negative brush. It branches its course along the main conductor and is collected by the contact rollers on other cars in the same manner. The single rails are connected by copper wires rivetted to them. On the top of each car is erected, at an angle of 40 degrees, an iron supporting rod which carries a grooved contact roller pressing against the underside of the conductor. Suitable leading devices are arranged at crossings so that the contact rollers keep in position. There are two 10 H.P. motors to each car and they are fixed in a specially built framework. Each motor drives one of the two axles, and each car is fitted with brakes, track brushes for removing obstacles off the rails, and safety appliances. Throughout the line there are numerous curves most of which are of small radius, but these are all traversed with great facility. At present there are in service five to six passenger cars, to each of which a separate car can be attached according to the requirements of the traffic. A car depôt has been erected in the rear of the gas works and several pits have been dug in order to render the motors readily accessible. —Abstracted from the *Elektrotechnische Zeitschrift.*

FIELD'S MAKE AND BREAK TELEPHONE.

MR. STEPHEN W. FIELD'S work in the various branches of telegraphy and electric railroading is probably well known to our readers, but his versatile genius has also led him in the direction of telephony. One of the results of his work here has been the production of a telephone which automatically makes and breaks its circuit with a rapidity too great to be perceptible to the ear; he combines this with a diaphragm in such a way that sound waves projected against it are caused to bridge over the makes and breaks to a degree exactly proportional to the sound waves' rapidity of succession.

The accompanying engraving, fig. 1, shows two such diaphragms, D and M, supporting respectively two contact points, E and G. One diaphragm is supported above the other, and is kept in a state of tension by connection with a fine wire, C, of considerable resistance.

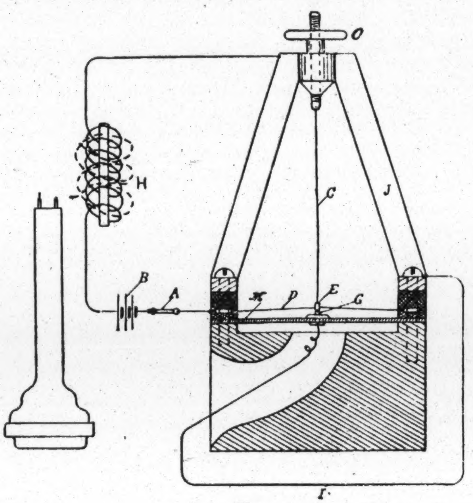


FIG. 1.

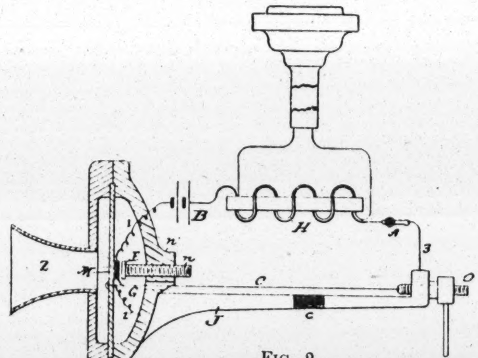


FIG. 2.

It will be seen that the circuit of battery, B, passes normally through the insulated metal frame, J, of the telephone, and the wire, C, to the diaphragm, D. It will also be observed that there is a short circuit, by way of the wire, I, between the contact point, G, and the frame, J. The strain of the wire, C, is normally sufficient to separate the contact points, E and G, but when the switch, A, is closed and the current from battery, B, traverses wire, C, the latter will elongate and allow the points to come in contact. The current will thus be shunted around wire, C, through a path of approximately no resistance, with the result of cooling and contracting C and separating the contact points.

The function of the device is, in fact, that of a circuit-breaker of such rapid action under the influence of the current of the battery, B, that the vibrations are outside the receptivity of the ear. It follows that the sound waves striking the diaphragm, F, will alter the relative positions of E and G, and tend to prolong their contacts, making audible, and, if in proper sequence, articulate speech.

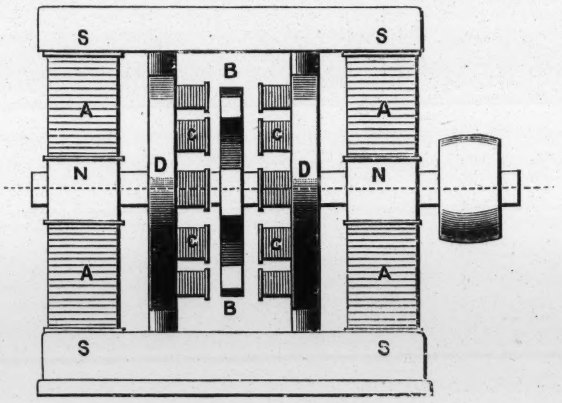
In fig. 2 is shown an arrangement for applying the same idea to a carbon transmitter for the purpose of increasing its sensitiveness. In this construction the carbon, which is mounted on the diaphragm, is kept in contact with a corresponding platinum contact piece by means of a fine wire under tension attached to the diaphragm. The contact expands the wire C, thereby tending to break the circuit; but the consequent cooling of the wire contracts the same and closes the circuit.

With the construction here illustrated an equilibrium is set up between the elongation of the wire, C, and the resistance at the carbon contact, the result being that the pressure of the carbon is kept automatically at the most delicate point and a self-adjusting carbon transmitter is obtained. The changed thermostatic condition of the primary circuit is brought about in this construction by a rupture of the circuit, due to the elongation of the resistance wire, or, rather, by an increase in the resistance of the circuit, and not, as in the other form, by the introduction of a shunt around the resistance wire.

The makes and breaks of the automatic circuit breaker produce no audible effects upon the circuit by reason of the great rapidity with which they follow each other. That is to say, the normal vibrations of the circuit breaker, considered with respect to their capacity to reproduce sounds, are neutral or inharmonious. That which reduces them to harmony and enables them to reproduce sounds is the combination, with the apparatus which produces them, of devices which bridge over or throw together more or fewer of the inharmonious vibrations and thus alter their natural sequence.

AN HISTORICAL ALTERNATOR.

BY the courtesy of Messrs. Paterson and Cooper, we are enabled to give here a sketch of the Lever Alternating Current Dynamo, to which reference was made last week in our leading columns. On the two upright magnets, which also serve to carry the bearings for the star wheel, B, are four magnetising coils, A. The spokes of the wheel are eight in number, and there are 32 fixed coils, C (a few of which are shown), 16 being arranged on each side of the wheel. The coil cores are fastened into the ring cheeks, D, D, while the whole is bound rigidly together by the sole and top plates, S, S. All the wheel spokes are of similar polarity, as the current circulates in the magnetising coils to produce poles, N and S, as marked. The sketch really explains itself, and the faults of the design will be as obvious as the resemblances to Prof. Elihu Thomson's machine described last week. The substitution in the latter of one circle of radiating coils for the two circles in Lever's is a distinct improvement, as is also the winding of the magnetising coils concentric with the axis, and employing two instead of four. The necessity for laminating the magnet wheel is one of the things that



Lever would have found necessary had he gone on with his machine. That he did not follow his ideas a little farther is a circumstance to be regretted, as it is highly probable that the process of evolution to which all new designs are subject would have produced a machine nearly similar in detail as it was in principle to the latest American novelty.

THE MUNICIPAL ELECTRICAL WORKS AT TRIENT.

[FROM A CORRESPONDENT.]

THE following particulars are given on good authority concerning the electric illumination of Trient and the cost of the installation. The works are driven by water-power, and were erected by Siemens and Halske. The municipality of Trient has already paid upwards of 500,000 florins for the arrangement of the present water-power of the Fersina, amounting to 600 H.P., and in order to make sure of this power during the time when the river is low, they will have to tap the lakes on the Pine, which lie at the distance of 12 kilometers up the valley, so as to utilise them for making up the water supply if deficient, which with all the additional rights to be acquired, will involve a fourth outlay of at least 150,000 florins. The town, with a population of 20,000, expends, therefore, more than 650,000 florins for its electrical works, to supply 6,000 glow lamps or their equivalent in arc lights or in power. Already 4,450 glow lamps and 30 arc lamps are set up, and there still remains 120 H.P. for the transportation of power. Of the latter, 50 H.P. are already disposed of, and the residue will soon be required, in consequence of the unusually favourable conditions proposed, so that the entire installation will soon be in full work.

If we look at the financial phase of the question, we see a surprising result. Deducting the 440 glow lamps and the 30 arc lamps for street lighting, the income of the town from the undertaking is :—

For 4,000 glow lamps at 12 candles average at 50 kreuzer per month, or 6 florins yearly	24,000	florins
For hire of 120 H.P. at 10 florins yearly	4,800	„
Total	28,800	„

But the town has to meet the following outlay :—

Management, working and maintenance, according to the experience of similar installations	18,400	florins
Interest on capital	26,000	„
Sinking fund and money necessary to be written off, including depreciation at 0·5 and 5 per cent...	17,875	„
Outlay, total	62,275	„
Deduct returns	28,800	„
Deficiency	33,475	„

which the city has to charge to the account of public lighting.

Hitherto the city has paid for public lighting :—

Gas	8,600	florins
Petroleum, in outward radius ...	2,000	„
Total	10,600	„

The town will expend therefore in future more than three times as much for public lighting as heretofore. It must be remembered that the change has been from gas to electricity, which, under favourable circumstances, produces no increased outlay, and is sometimes even a saving. It must further be considered that Trient is by no means a wealthy city, and that it now raises 180 per cent. of the imperial taxation as a communal tax. Surely, many a city may take an example and indulge in a luxurious system of lighting! But we must add that the estimate for the electric lighting of Trient was, originally, only 210,000 florins, and the abnormal cost of execution was by no means the intention of the Trient municipality.

COMMUNICATIONS FROM AUSTRIA-HUNGARY.

[FROM A CORRESPONDENT.]

THE Vienna International Electrical Company has applied to the authorities at Buda-Pest for a concession to erect and work an electrical works for supplying electricity for illumination, the conveyance of mechanical power, and other industrial purposes. The company apply for the concession for 50 years, after which time the entire works are to pass gratuitously into the possession of the city. But it is open to the municipality to terminate the agreement after the lapse of 20 or 30 years, that is to say, after 20 years, on a payment of 20 per cent. above the valuation, or at the end of 30 years simply at the valuation. For the right of using the public streets to lay down the cable leads, the company would pay the municipality 3 per cent. of the gross returns. It is to be presumed that the capital of Hungary will at last come into the possession of electrical works.

In the Hungarian port, Fiume, proposals were requested for the erection of a mechanical elevator at the railway station. Electrical motors are proposed, which are to be supplied with current from the works projected for the illumination of Fiume.

At present telephone central stations are being erected in the cities of Fiume, Raab, Oedenburg, and Esseg. Several extensive landowners are also connecting the buildings on their possessions with telephonic sets. The company, for regulating the river Raba, is doing the same, and is connecting the various stations on their regulating line by telephones constructed by Egger and Co., of Buda-Pest.

The last weeks have been characterised by violent thunderstorms, especially in the mountainous parts of Austria, and several falls of lightning are reported.

At Marienbad the lightning struck repeatedly in two successive nights at various parts of the overhead leads of the electrical works. The machines were deprived of current after the strokes, but were not further damaged, and have since worked correctly. It is announced from Villach that in the night, between the 4th and the 5th of the current month, one storm followed another from 9 p.m. to 6 a.m. Flash followed flash, the thunder was unceasing, and the rain and hail destroyed the residue of the crops. Ten times the lightning fell in the city and suburbs. Two strokes followed each other in quick succession along the lightning rod of the tower of the parish church and destroyed the apparatus upon it and the one below it in the police watch-house, where the officer on duty was rendered unconscious. Another flash struck the house of General Six, tearing down the tiles and the timbers of the roof. Further flashes struck the railway bridge over the Drau, some trees, and an Alpine hut, which was burnt down. According to report, buildings were set on fire in the same night at Tarsis and St. Veil. The church-tower of Leopoldskirchen, which, like most of the towers in Corinthia, had no conductor, was burnt to ashes. On July 31st, two towers were fired by lightning at Lavamünd, and at Kolnitz two bells were melted and one shattered. In the afternoon two more storms burst over Villach. During the second a woman was killed. In consequence of the torrents of rain, the Drau has risen three metres and caused much damage.

The Hungarian Minister of Commerce has granted a concession for laying down the leads for the electrical works at Karanseles, which will be carried out with alternating current transformers at a tension of 2,000 volts. This is the first concession granted by the Hungarian Ministry for such an installation, and the conditions of the concession will be a standard for the erection of overhead leads of high-tension transformers.

The conditions prescribed are as follows :—

1. The aerial leads must not be stretched too tightly. At 20° Centigrade they must not be strained above one-third of their total tenacity, and wires of less than 3 mm. in diameter must not be used.

2. The heating of the wires by the current must not exceed 20° C.

3. The leads must be fixed upon rod supports in such a manner that the wires run at least two metres above the roof. If this is not possible, they must be conducted at least 6 metres above the roadway.

4. Where lighting wires and telegraph wires cross each other, the former must be at least 2 metres higher than the latter, and due precaution must be taken to prevent these respective wires coming in contact.

INTERRUPTIONS AND REPAIRS TO SUBMARINE CABLES, 1888—1889.

Name of Company.	Section.	Interrrupted.	Repaired.	Number of days interrupted.	Total for each section.
African Direct (2,743 N.M.)	Sao Vicente—Sao Thiago	2nd Jan., 1888	2nd Feb., 1888	31	31
	Sierra Leone—Accra	11th Oct., 1888	20th Oct, 1888	9	9
	Accra—Lagos	25th July, 1888	8th Sept., 1888	45	45
	Lagos—Brass	?	15th May, 1889	?	?
Anglo-American (10,196 N.M.)	Brest—St. Pierre	24th Sept. 1888	1st Oct., 1888	7	
	,, ,,	18th July. 1889	6th Sept., 1889	49	
	,, ,,	18th Nov., 1889	12th Dec., 1889	24	80
Black Sea (346 N.M.)	Constantinople—Odessa	29th Feb., 1888	5th April, 1888	36	
	,, ,,	12th Jan., 1889	21st Feb., 1889	40	76
Brazilian Submarine (7,326 N.M.)	Lisbon—Madeira	1st Sept., 1888	3rd Sept., 1888	2	2
Central and South American (3,178 N.M.)	San Juandel Sur—Panama	4th June, 1889	5th June, 1889	1	
	,, ,,	29th July, 1889	7th Aug., 1889	9	10
	Santa Elena—Payta	15th May, 1889	21st May, 1889	6	6
Eastern (21,859 N.M.)	Gibraltar—Tangiers	29th Dec., 1887	30th Dec., 1887	1	
	,, ,,	10th Sept., 1889	23rd Sept., 1889	13	14
	Chio—Tenedos	13th Nov., 1888	20th Nov., 1888	7	7
	Suez—Suakim	6th Mar., 1888	5th April, 1888	29	
	,, ,,	21st Nov., 1888	27th Nov., 1888	6	35
	Suakim—Perim	6th Mar., 1888	20th Mar., 1888	14	
	,, ,,	21st Nov., 1888	11th Dec., 1888	20	34
	Aden—Bombay	11th July, 1888	11th Sept., 1888	62	62
Eastern Extension (12,958)	Saigon—Hongkong	28th April, 1888	7th May, 1888	9	9
	Haiphong—Hongkong	28th April, 1888	30th April, 1888	2	
	,, ,,	7th May, 1888	11th May, 1888	4	6
	Banjoewangie—Port Darwin	30th June, 1888	18th July, 1888	20	
	,, ,,	10th Oct., 1888	15th Oct., 1888	5	
	,, ,,	22nd Oct., 1888	29th Oct., 1888	7	32
	Australia—New Zealand	9th Aug., 1889	20th Aug., 1889	11	11
Eastern and South African (6,571 N.M.)	Mossamids—Port Nolloth	1st July, 1889	7th Aug., 1889	37	37
Great Northern (6,110 N.M)	Shanghai—Nagasaki	8th July, 1888	14th Aug., 1888	37	37
Italian Government (1,027 N.M.)	Milazzo—Lipari	29th Nov., 1888	11th Dec., 1888	12	
	,, ,,	14th Sept., 1889	23rd Sep., 1889	9	21
	Assab—Massowah	13th June, 1889	18th June, 1889	5	5
Mexican (709 N.M.)	Galveston—Tampico	28th June, 1888	20th July, 1888	22	22
River Plate (32 N.M.)	Monte Video—Buenos Ayres	10th Oct., 1889	14th Oct., 1889	4	4
Spanish Government (135 N.M.)	Javea—Ibiza	11th Feb., 1888	20th Sep., 1888	224	224
Turkish Government (331 N.M.)	Dardanelles—Pera	30th Dec., 1887	4th Jan., 1888	5	5
	Suakim—Djedda	10th May, 1889	21st May, 1889	11	11
West African (3,015 N.M.)	Balama—Bissao	2nd May, 1888	28th Aug., 1888	118	118
Western and Brazilian (3,761 N.M.)	Para-Maranham	4th April, 1888	16th April, 1888	12	
	,, ,,	6th Sept., 1888	24th Sept., 1888	18	
	,, ,,	2nd Nov., 1888	14th Nov., 1888	12	
	,, ,,	21st May, 1889	4th June 1889	14	56
	Maranham-Ceará	3rd Jan., 1888	16th April, 1888	44	
	,, ,,	27th May, 1889	31st May, 1889	4	48
	Pernambuco—Bahia	1st April, 1889	20th April, 1889	19	
	,, ,,	20th July, 1889	27th July, 1889	7	26
	Bahia—Rio de Janeiro	12th Jan., 1888	9th Feb., 1888	28	
	,, ,,	30th Jan., 1889	5th Feb., 1889	6	
	,, ,,	3rd Sept. 1889	18th Sept., 1889	15	
	,, ,,	21st Sept. 1889	6th Oct., 1889	15	64
	Rio de Janeiro—Santos	16th April, 1889	25th April, 1889	9	9
	Santos—Santa Catarina	18th Oct., 1889	24th Oct., 1889	6	6
	Rio Grande do Sul—Monte Video	25th April, 1889	11th May, 1889	16	
	,, ,, ,,	11th June, 1889	27th June, 1889	16	
	,, ,, ,,	4th Dec., 1889	6th Dec., 1889	2	34
West Coast of America (1,698 N.M.)	Chorillos—Mollendo	11th Dec., 1888	20th Dec., 1888	9	
	,, ,,	19th July, 1889	25th July 1889	6	15
West India and Panama (4,119 N.M.)	Jamaica—Colon	5th Nov., 1887	31st Jan., 1888	56	
	,, ,,	22nd Dec., 1888	19th Jan., 1889	28	84
	St. Vincent—Barbadoes	13th Feb., 1888	8th Mar., 1888	26	
	,, ,,	12th April, 1888	18th April, 1888	6	
	,, ,,	12th May, 1888	22nd May, 1888	10	
	,, ,,	19th Jan., 1889	26th Jan., 1889	7	49
	Trinidad—Demerara	5th Nov., 1888	12th Nov. 1888	7	
	,, ,,	13th Dec., 1888	27th Dec., 1888	14	
	,, ,,	3rd Feb., 1889	9th Feb., 1889	6	
	,, ,,	20th Mar., 1889	22nd Mar., 1889	2	
	,, ,,	23rd May, 1889	6th June 1889	14	
	,, ,,	19th Dec., 1889	7th Jan., 1890	19	62
Western Union (5,537 N.M.)	Atlantic	12th Sept., 1889	2nd Jan., 1890	112	112
	Punta Rassa—Cay West	4th June 1888	5th June, 1888	1	
	,, ,,	5th Jan., 1889	18th Jan., 1889	13	
	,, ,,	29th Jan., 1889	12th Feb., 1889	14	28

AN ACCOUNT OF SOME EXPERIMENTS UPON THE APPLICATION OF ELECTRICAL ENDOSMOSE TO THE TREATMENT OF GOUTY CONCRETION.

Presented to the International Medical Congress at Berlin by THOMAS A. EDISON, of New York.

HAVING ascertained that gouty concretions are in many cases medically treated with the aid of lithium salts taken internally, with the object of causing urate of lithium to be formed, dissolved, and excreted from the body; and being also informed that the difficulty met with in the treatment was in ensuring that the salts so administered should be absorbed into the system, it occurred to me that perhaps more rapid success might be obtained if the application were made externally, employing the well known principle of electrical endosmose to carry the lithium into the tissues. This method of operation appeared to offer considerable hope of success, because the lithium would be brought directly into the neighbourhood of the concretions and would thus be more likely to act promptly and effectively.

Electrical endosmose, as the name implies, is that property of an electrical current passing through a porous diaphragm between two solutions, in virtue of which one solution is mechanically transferred across the barrier. The current seems, in fact, to accelerate the diffusion which always takes place between solutions separated by a porous diaphragm, and at the same time acts in one direction, the solution being carried from the positive to the negative pole, from the anode to the cathode. A full description of the phenomenon is given in Wiedemann's "Die Lehre von der Elektricität."

To test the possibility of causing lithium salts to pass in this way through an animal membrane, I made the following experiment:—

A glass funnel of 7·5 centimetres diameter at aperture was closed by a piece of sheep bladder 0·012 cm. thick, thus providing a porous diaphragm of 44 sq. cms. area. This funnel was inverted and filled with slightly acidulated water, and a platinum wire passing down the tube formed the negative electrode. The whole was then immersed about 1 cm. below the surface of a 2½ per cent. solution of LiO_2 contained in an evaporating dish above the bottom of which it was supported about 1·25 cms. Immediately after immersion, a second platinum wire forming the positive electrode was dipped in the dish, and a current of 150 milliampères sustained steadily through the apparatus for 75 minutes. The funnel was then removed and emptied. Its contents were mixed with a solution of $NapO_3$, and the mixture evaporated to dryness. The residue was then treated with water to dissolve the sodium salt and then left for 12 hours. The final precipitate was found to contain 0·5 gramme of $LiPO_3$.

The experiment was then repeated under precisely similar conditions except that no current was passed through the apparatus and diffusion only could be active in transferring the salt. The analysis in this case showed that 0·3 gramme of lithium phosphate was present, from which it was presumed that in the previous instance the current had increased the diffusion transfer to the extent of 67 per cent.

Finding the experiment succeed with a membrane, I next tried whether a healthy man, after being subjected to such a course of treatment as a patient suffering from concretions might be expected to undergo, would not give indications of the absorption of lithium in his excretions. In October, 1889, J. D., an active healthy labourer, aged 20, and of 140 lbs. weight, was operated upon in my laboratory. He sat in a chair and kept his hands immersed to the wrists in glass jars, one containing a solution of 2 per cent. lithium chloride with a platinum electrode, and the other containing a solution of common salt with the negative electrode. The current passed through him was 4 milliampères, which was as much as he could conveniently stand. This treatment was continued for about two hours daily during one week, the total time of application amounting to 11 hours. His urine was collected during that week, and tests were then applied to it. Using a particular spectroscope and method, it was found that a solution containing $\frac{1}{40000}$th part by weight of LiCl in water was just dectectable by a faint red band in the spectrum. No such band could under these circumstances be discerned from the urine itself, but a condensation of all the week's urine reduced to the form of chloride gave a distinct band. An evaporation of $\frac{2}{5}$ths of the total quantity of this liquid yielded on analysis 0·22 gramme of lithium chloride, and it was therefore presumed that the whole amount of salt excreted was 0·55 gramme, corresponding to 0·09 gramme of metallic lithium, or equivalent to the removal of 2·43 grammes of uric acid.

I next tried the application of the method to a patient suffering from an acute and typical form of the malady, in December, 1889. This person volunteered to try the effect of the method. He was 73 years of age, and had lived an active healthy life until ten years previously, at which time, according to his own statement, he contracted the disease through sleeping in damp sheets. Concretions commencing continued to increase slowly until they assumed large proportions. All the joints, except the knees, were much enlarged by atheromatous concretions. A certain degree of venous congestion was visible in his face, and incessant pain had supervened in various parts of the body during the last few months, apparently from the pressure of the calculi upon the nerves. The joints of the fingers were almost obliterated by concretion.

The girth of the little finger of the left hand was, by careful measurement, 8·6 cms., that of the corresponding finger on the right hand even greater. There was great weakness and difficulty in walking, but the mind was clear, and intelligence unimpared.

Treatment was commenced in the manner above described. The current generated from my laboratory 120 volt dynamo, passed through about 5,000 ohms resistance, and entered a jar containing an aqueous solution of lithium chloride, density 1·08, in which the patient immersed his left hand up to the wrist. His right hand was similarly immersed in a solution of common salt. The current, after passing through his body, left the latter jar by a negative electrode. It was found that he could stand 20 milliampères without inconvenience, and this strength of current was steadily applied for six days during four hours daily. At the end of that time the girth of the left hand little finger was distinctly reduced to 8·2 cms.; the patient also experienced freedom from pain after the first day's treatment. He continued the treatment for two days more during the week following, and then the journey to and from the laboratory exhausted his strength. The finger girth, after 14 days trom the date of commencing treatment, was 8·0 cms., a total reduction of 0·6 cm. This was estimated to represent a reduction of 3 ccm. of concretion on this particular finger, whose form facilitated accurate measurement. His general condition, beyond the weakness resulting from unaccustomed journeying, was temporarily ameliorated.

From these experiments, I think it fair to conclude that satisfactory use can be made of the principle of electrical endosmose in such cases.

It should be mentioned that lithia was first tried in the bath solution, and given up on account of its caustic effects. Even an aqueous solution of 1 per cent. of lithia was found to blister the hands after some continued immersion. It would, therefore, have been necessary to employ a very weak solution, had its use been retained, with a correspondingly lengthened course of treatment, but time did not allow of. The chloride was used in the expectation that it would be decomposed within the cuticle during the act of endosmose by electrolytic action, or that, failing this, it would enter into a direct combination with the uric acid,

NOTES.

Voltaic Battery with Iron Electrode in Pure Water.—The *Comptes Rendus* of the French Academy of Sciences for 1862, page 700, describes Gerardin's battery, in which the zinc is replaced by a mass of iron filings, and an iron bar inserted into said filings, both being placed in pure water. The other electrode is of carbon, and is placed in a porous cup containing a solution of perchloride of iron and nitro-muriatic acid. This is a pertinent reference for the d'Humy primary battery, as it fully discloses an iron electrode placed in pure water.

Dynamos in Central Stations.—We notice in the issue of *Industries* for August 15th, the first instalment of a paper by Mr. James Swinburne, on the "Coupling and Control of Dynamos in Central Stations." The subject, and its method of treatment, are alike interesting; there is plenty of room for an article of this description.

The Telephone in the West Indies.—The Spanish Minister of the Colonies has received authorisation to grant concessions for establishing telephonic communications in the Islands of Cuba, Puerto-Rico, and the Phillipines.

The Spanish Atlantic Cable Again.—Once more has this annual blossomed. Whether a crop of fruit will be obtained is another question. We learn that the Spanish Minister of the Colonies has again offered that hardy plant, the direct cable between Spain and the West Indies, to public tender.

Recent Interruptions and Repairs to Submarine Cables and Land Lines.

Section.	Interrupted.	Repaired.
Cable Benzuela—Mossamedes ...	16 June, 1890,	2 July, 1890.
„ Suez—Suakim	9 May „	9 „ „
„ Jamaica—Colon	15 July „	still interrupted
„ Banjoewangie—Port Darwin	11 „ „	20 July, 1890
„ Banjoewangie—Roebuck Bay,	11 „ „	still interrupted
„ Hongkong—Foochow ...	21 „ „	„
„ Amoy—Shanghai	21 „ „	„
„ Maranham—Para	24 „ „	„
Land Lines, Transandine ...	10 „ „	11 July, 1890
„ „ Siberian	15 „ „	15 „ „

Private House Lighting.—The lighting of the "Manor House," near Twyford, has just been completed for W. L. Beale, Esq. The installation consists of an eight horse Priestman's oil engine, Crompton dynamo, and 53 E.P.S. cells, with about 120 incandescent lamps, and shortly the current will be utilised to pump water for the house. It is hardly necessary to say that the light gives the greatest satisfaction. The work of the installation was carried out by Mr. W. V. Scott, under the instructions of B. R. Beale, Esq., of Messrs. Crompton and Co., Limited.

Electric Lighting at Woolwich.—As anticipated, the Woolwich Local Board of Health has given consent to the Woolwich District Electric Light Company for the lighting of the town by the electric light.

Electric Lighting at Canterbury.—The Canterbury Corporation has passed a resolution in favour of making application to the Board of Trade for a provisional order to supply electricity for public and private purposes in the City and Borough of Canterbury.

New Spanish Cable.—The *Official Gazette* of Madrid, under date of August 18th, publishes an official announcement inviting tenders for the construction and laying of cables between Tarifa and Tangier, Tarifa and Centa, Almeria and Melilla, and other Spanish possessions on the coast of Morocco.

A New Use for Rubber.—We learn that the municipal authorities of Brussels have decided to experiment upon the new compound called "caoutchouc macadam." A portion of the Boulevard Anspach is being paved with this material. The compound consists of a mixture of India-rubber and different kinds of stones, ground up together, and thus converted into a sort of cement by means of heat. The material is stated to be hard, elastic, and durable, and to be unchanged by either heat or cold. If the mixture possesses the properties claimed for it we should fancy that it would be pre-eminently suitable for running tracks, and lawn tennis courts.

Electric Railway in Sweden.—We have to chronicle the construction of an electric railway at Boxholme, Sweden. It is intended for the carriage of manufactured articles from the ironworks to the store-houses. The motive power is a 50 H.P. turbine, working two of Wenström's dynamos. This railway is, we believe, the first of its kind in Sweden.

The New Thomson Dynamo.—A communication from Prof. Thomson to the *Electrical World* gives some interesting facts concerning his new dynamo, described in our last issue. It will be remembered that the principal electrical characteristic of the machine was absence of hysteresis in any marked amount, while the construction adopted possesses the great advantage of requiring no revolving wire. The construction of the machine has actually been simplified, even beyond the point shown in our illustrations, so that it is exceedingly easy to construct and prepare. Several have already been built—most of them of similar size, and one of them for alternations as rapid as 2,500 complete reversals per second. The construction of the machine as a dynamo lends itself very easily to obtaining such high rates of alternation as are rendered highly desirable in certain classes of work. If the suggestion referred to some time since, of making transformers without iron cores, is ever carried out this new Thomson dynamo should come into play with beautiful effect. Of course, in a converter without iron, very high alterations are absolutely necessary to economical and efficient construction; but the advantages to be gained are great enough to make it a very interesting subject for experiment. In such case it should be noticed that any dynamo in which the magnetisation of a considerable mass of iron is reversed at each alternation is practically excluded from use, since hysteresis would rise to an enormous amount, while the present machine, from almost complete absence of hysteresis, is admirably fitted for the purpose. A 1,000-light dynamo of the new form has already been constructed, and is in process of testing. It has shown remarkably good results, and it is specially noticeable that the iron is free from heating, and the efficiency eminently satisfactory. A still larger machine is being planned, and there seems to be no good reason why the capacity may not be increased almost indefinitely.

Electric Light and the Daily Press.—Our bright little pink contemporary, we don't mean the *Sporting Times*, but the "*Globe*," a few evenings since had a somewhat superficial article on the subject of electric light in churches. It seems to think, and says, "The ladies are by no means unanimous in its favour, for it does not always add to the beauty of the complexion;" in this respect the writer of the roseate one's article appears to share the ignorance of the ladies when discussing the same subject, for at St. Jude's Church, of the illumination of which he is speaking, the lighting is to be by incandescence lamps of 8 candle-power and not by arc lights, which are well known to give a cold effect to the tone of even the most radiant faces. Again he says, "A church which is all glare from beginning to end—in every corner—is not acceptable to everybody;" just so! but we do not consider that glare is usually to be dreaded when 8 candle-power lamps are to be employed in a spacious building.

A Trifling Request.—Will some kind friend, who is not an editor, and who, therefore, may find time hang heavily on his hands, answer the following questions which an Indian subscriber has forwarded to us:—Could you inform me of what is the portable battery of four cells for electric lighting, by J. Pitkin, maker and patentee, made, and with what charged? In making a horseshoe magnet, what is the minimum distance the poles or ends should be apart? What would be the result or effect of their being brought very near, short of actual contact? If a Siemens' relay were fitted with larger slots or shoes, so as to extend, as it were, the whole length of the tongue, what advantage would there be, if any? In the differential system of duplex, double current, translation with Siemens' relays, does the want of insulation between the cores and the brass cylinder, and hence between the rest and working stops of the relay, and the cores when the tongue is either in the rest or working position, interfere with the efficiency of the relay in direct translation? How can the following fault be localised? A line is in contact with another which is worked in "closed circuit," and over which the testing station has no control, supposing a "loop" with another available line possible.

Ryde Electric Railway.—On the last Bank Holiday over 6,000 persons were carried along the electric railway on Ryde Pier.

National Electric Light Association.—The meetings commenced on Tuesday, and were to terminate yesterday. Among the papers read were the following, a selection of which will be given in a subsequent issue. "Electric Light as Supplied to Steam Railroads," W. H. Markland, Altoona, Pa. "Triple Expansion High-speed Engines for Central Station Work," E. F. Williams, Beloit, Wis. "Ferranti Station, London, England," Caryl Haskings, Lynn, Mass. "The Proper Care and Management of Alternating Currents," T. Carpenter Smith, Philadelphia. "Distribution of Energy by Alternating Currents and Transformers, and the Proper Method of Proportioning Conductors," A. H. Rohrer, Lynn, Mass. "The Proper Basis for Determining Electric Motor Rates," H. L. Lufkin, New York. "Actual cost of furnishing Arc Lighting (1,200 C.P., and 2,000 C.P. Lamps) under the Best Possible Conditions," J. C. Ayer, St. Louis. "Municipal Ownership of Electric Lighting Plants," M. J. Francisco, Rutland, Vt. "Accidents in Electric Lighting Stations and Plants," Prof. Charles R. Cross, Boston. "Care and Labour in Electric Light Stations and its Value," A. J. DeCamp, Philadelphia. In addition to these papers, various reports were to be considered.

The Joke of the P.O. Electrician.—Speaking of the recent scientific joke, our contemporary, the New York *Electrical World*, says:—The principal London electrical papers escaped unscathed, but the small fry, and some large enough to know better, were with one accord taken in. As might have been expected, when it transpired that the supposed invention was a hoax, the victims were somewhat demoralised, and while some of them preserved a discreet silence, others waxed wroth and growled out protests.

The Lane-Fox Patents.—In connection with this a meeting was held last week of various firms interested, and it was resolved to form an association on the lines of the circular published in the REVIEW on August 8th.

The Volta Electrical Company, Limited.—Creditors of the company are to send their names and addresses of their solicitors, if any, and particulars of debts and claims to Mr. Thos. Browett, Sandon Engine Works, Salford, Manchester, the liquidator, on or before 19th September next, or to be excluded from any distribution made before such debts or claims are proved.

An Extraordinary Robbery.—A correspondent of a daily paper states a most extraordinary case of robbery in Paris. Six thousand metres of cable had disappeared from the Champ-de-Mars, while at the other end of the city, in the Avenue Daumesnil, near Vincennes, an exactly similar length of wire was missing. Furthermore, an inspector from the Post Office discovered that the cable between the Rue de Grenelle and the Rue de Villejust, as well as that connecting the Place de la République with the central markets, had been cut in different places. It appears that all this damage—which caused much delay, inconvenience, and complication—was done by two professional excavators or "navvies," named respectively Chartier and Haurant. These men, who probably had assisted in putting down the wires, were in the habit of carrying on their operations at night, when they descended into the drains or cuttings with dark lanterns, and carried away both the cables and their environments. The principal delinquents were each condemned to 15 months' imprisonment, while the receivers were sent to gaol for shorter periods—a salutary example being thus made of the destroyers of telephone wires, and one which, it is to be hoped, will prevent other ingenious persons from endeavouring to imitate the mischievous deeds of the scientific "navvy" and his colleague.

Telephone Monopoly in Germany.—The well-known Telephone Manufacturing Company, Actien Gesellschaft, Mix and Genest, has been successful in an action brought against the Government as to the building and maintaining of telephone lines. Previously the German Post Office succeeded in prohibiting all telephone installations erected by private companies. By the spirited action of the company this state of things has been entirely altered.

Car Companies at Chicago.—Two new car companies have been started at Chicago—the Columbia Street Car Manufacturing Company, capital, $100,000, and the United States Electric Car Company, for the manufacture of electric cars, capital $3,000,000.

Fire at the Edison and Swan Factory.—A fire broke out in the depositing rooms of the Edison and Swan Electric Factory, at Ponder's End, on Tuesday morning. This portion of the factory is divided from the remainder by a thick party wall of great height. The cause of the fire was the igniton of some benzoline used in the work. The fingers of the girl using the benzoline were hurt, but about fifty other girls, to whose benches the fire quickly spread, were got out of the place uninjured. The local fire brigade attended, but their efforts were confined to preventing the flames from spreading. They thus saved the remainder of the premises, but the depositing building was destroyed. The amount of the damage is not known, but it is very considerable.

Percussion Cap Lightning Arrester.—In a recently made American arrester ordinary percussion caps are employed to break the arc which so often follows the static discharge. The heat produced by the current when the arc is formed explodes the cap, thus blowing out the arc. It is said to work admirably in practice.

Fan Motors.—During the recent hot weather in America motors have been largely used for propelling fans.

Tenders for Lighting.—For lighting the parish of Heavitree with gas or electricity, for three years from 24th October. Full particulars from G. Havill, jun., Fore Street, Heavitree. Tenders to be deposited by the 30th. Tenders wanted, by 1st September, for lighting Kinsale, Ireland. Mr. Hegarty, Town Commissioners' Office.

"Manganese-Steel." — Mr. Hadfield, of the Hecla Works, has been awarded a gold medal by the Société d'Encouragement pour l'Industrie Nationale for an entirely new alloy of iron and manganese.

The Claims of Primary Batteries.—A company is now engaged in America exploiting a certain form of primary battery, and in its descriptive circular the main object appears to fascinate the gullible public by quoting the historical details of Jacobi's boat experiments on the Neva more than 50 years ago, and Professor Page's car trip in 1851. The climax is reached, however, when we see that the "eight horse-power machine on our car will develop more actual mechanical horse-power (as operated by the primary batteries) than the combined power of two 10-H.P. motors as now operated by the several dynamo methods." The example of George Washington is evidently emulated by but few inventors in the States.

Award.—A Gold Medal has been awarded by the Société d'Encouragement pour l'Industrie Nationale to M. Ducretet, of Paris, for his services to science and industry, amongst which may be noted a Wimshurst induction machine of great power and an ingenious device for reproducing Professor Elihu Thomson's experiments in connection with electro-dynamic repulsions and rotations.

Alternating Currents Doomed.—The Société Industrielle du Nord de la France has awarded a silver medal to M. Lafargue, for a note on the distribution of electric energy by alternating currents. M. Lafargue is of opinion that alternating currents will, sooner or later, fall into disuse.

Electromotors and Weaving.—MM. Chaize frères, weavers, of St. Etienne, have been awarded a gold medal by the Société d'Encouragement pour l'Industrie Nationale for an ingenious application of electromotors, which they have been using in their workshops for some time. The Société has also conferred a similar honour upon M. Monchère for an ingenious application of electricity to the reeling, weighing, and making up into balls, of silk and similar woven fabrics. A silver medal of the same Société has been awarded to M. Radiguet, of Paris, for his electric knitters for use in the hosiery trade.

Obituary.—*Electrical Industries* of America says :—Mr. James W. Queen, founder of the celebrated house of Jas. W. Queen & Co., 924, Chestnut Street, Philadelphia, died July 12th, at Cresson, Pa., where he was visiting in the hope of receiving benefit from the mountain air. Mr. Queen had reached the good age of 78 years. His name occupies a prominent place in the business records of Philadelphia, and most of the high class English and American houses were at one period represented by him in Philadelphia. His integrity was beyond question, and no one enjoyed a better reputation.

Electric Lighting of Mines.—M. Le Compte Gerson has presented the electric mining lamp, Stella, to the Academy of Sciences.

Electric Lighting of the City.—A Committee of the House of Commons confirmed the two provisional orders, granted to the Brush Electrical Engineering Company and the Laing, Wharton, and Down Construction Syndicate, for lighting the City. The area to the east of the Mansion House, Princes Street, and Moorgate Street is assigned to the Laing Construction Syndicate ; and the area to the west of those points, as far as, and including, the north side of St. Paul's Churchyard, is assigned to the Brush Electrical Corporation. The orders have now been sanctioned by both Houses of Parliament.

Cable Testing.— Mr. C. H. Gray, of Silvertown, writing too late for our correspondence columns, says :—"The method described by Cuthbert Hall for localising faults, is practically the same as I employed eight or nine years ago at Persan for the same purpose, the only difference being that, instead of insulating the trough as he has done, I insulated the stand on which the bobbin containing the wire to be tested was supported. There is practically no difference between the methods, and both are simply improvements on Warren's old method of localising faults in core. The only advantage I can see in my method seems to be that in actual practice I used a long trough, and was thus able to travel at a considerably higher speed than could be attained with the short trough used by Cuthbert Hall. They are still, I believe, using the above method at Persan for localising faults in common bell-wire core."

Gas and Electricity.—Presiding at the half-yearly meeting of the Liverpool United Gas Light Company, on Tuesday, Mr. Edward Lawrence stated that so far as the application and use of electricity went, up to the present time he saw nothing to cause uneasiness to the proprietors of gas stock. It was quite true the consumption of electricity in Liverpool was increasing, but at the same time the consumption of gas had increased by 2 per cent., and he thought they might safely conclude that with other uses being found for gas the consumption would continue to be extended, while the use of electricity would also be increased.

Foreign Wire Industry.—The Italian Metallurgical Company is very busy just now with orders for electric wires.

Bimetallic Conductors. — The Administration of Posts and Telegraphs, France, is about to make a trial with the Durand system of bimetallic telegraph and telephone wires, composed of red copper with steel cores.

The Manufacture of Electric Motors.—As showing the great demand for motors, it is stated that the C. and C. Motor Company, of New York, have sold during the last six weeks 2,000 motors, which is equal to the sales of any previous year.

Fire Office Rules.—Major Flood Page, in a lengthy letter to the *Times* of yesterday, discusses the various fire rules of insurance companies. He had considered over twenty sets of rules, and came to the conclusion that the Phœnix Rules were the most acceptable in every way.

Martignoni Disc Cutting Tools. — The Machinery and Hardware Company of London, having obtained the sole right to manufacture the Martignoni patent disc cutting tools for lathes and general machine tools, have been demonstrating their value by showing them in actual work at their own show-rooms. These tools are expected to create quite a revolution in the turning and machine tool trade, as they are calculated to effect a saving of both time and material. They do away with the necessity for reforging or "fettling" tools, as the emery-wheel, in the hands of a boy, is sufficient to put a new edge on the tools in a few moments. There is no waste steel, and as vibration is avoided the machine can be run at a higher speed. No doubt many of our readers will be glad to have their attention called to this useful novelty, of which further particulars may be obtained on application to the company

New Insulated Wire.—We extract the following from the issue of the American *Electrical Engineer* for August 6th: — "The insulation of the American Circular Loom Company's wire, however, is not braided, but woven on by means of circular looms of improved type, the invention of Mr. Charles T. Stetson. The cotton is No. 12 single, and is twisted together at the factory in as many ply as is necessary for the size of wire to be covered. The twisted cotton is then put in the loom, which works exactly the same as looms for weaving flax fabrics, so many bobbins forming the woof, and so many bobbins being so shaped as to fit the shuttles which circulate round the loom and forming the warp. The looms are about four feet in diameter, and the mechanism is extremely simple and interesting to the eye of a mechanic. The shuttles move round very rapidly, the woof being moved up and down by means of eccentric rods on revolving discs, so that the warp passes below one thread and above the next one. When completed, the woven insulation is very hard and firm, and has the appearance of a canvas jacket, like a piece of sailcloth around the wire. The wire is then taken to the compounding house, where a special compound is forced into the cotton insulation by a secret process so effectually that every fibre of cotton is thoroughly impregnated. It is then polished and finished and wound on drums for shipment. When finished, the insulated wire has a peculiarly tough finish, and is particularly capable of withstanding a large amount of abrasion, and is at the same time as waterproof as any line wire with cotton fibre in the insulation can be, and is to a very extraordinary degree fireproof."

Microphonic Phenomena.—The paper which Mr. Tanner has courteously sent to us for publication on microphonic effects is exceedingly interesting, and will doubtless be appreciated by everybody engaged in telephonic pursuits. This gentleman has also unearthed the description of a battery, appearing amongst our "Notes," which anticipates the famous D'Humy cell, although the same feat has been previously accomplished by others.

Submarine Telegraphy Threatened. — It seems scarcely possible that the advent of electric railways should threaten a serious disturbance to signalling through long cables; yet the experiences of Mr. Cuttriss point to the possibility of grave complications arising from the proximity of heavily charged conductors interfering with telegraphic signals on the Atlantic cables. Probably, if this kind of thing developes so as to seriously interfere with business, an edict will be issued to prohibit any electric car running within a given distance of important telegraph lines, unless carrying its own motive power—in other words, it will be another argument in favour of accumulators.

Good News for "Okonite" Shareholders. — The Okonite Company, of New York and London, manufacturers of okonite insulated telegraph, telephone and electric light wires and cables, has completed its new factory at Passaic, N.J. It is an imposing three-storey brick building and employs 400 hands. The company is turning out on the average of 60 miles of okonite insulated wire per day, and is still a month behind its orders. It recently received an order for 1,000,000 feet of wire from the Chicago Edison Company, Chicago, Ill.

Electricity and Poetry.—There is a tendency among the Americans to fall into poetry when considering things electrical. Dr. Oliver Wendell Holmes has celebrated the electric car in a somewhat lengthy poem. He identifies the trolley poles as "witches' broomsticks," and, referring to the sparking, he says "we may see the gleam of her wicked eye."

Electropathic Quackery. — The *Hospital Gazette* says:—"It is high time measures were taken to stop the serious imposition practised on the public by a large body of men who—notwithstanding their professed ignorance of the first principles of anatomy, physiology, pathology, therapeutics, and electricity—set themselves up as experts, and largely advocate their worthless patents to credulous and easily-duped individuals, the majority of whom possess highly neurotic temperaments. Towards the suppression of such nefarious practice the press can exercise a mighty influence, and acquaint the public with the various ways they are being put upon by these tricksters and would-be benefactors to suffering humanity. The Electrical Review, we are pleased to see, has taken a prominent lead in this suppression, and formed a committee for this purpose. It is to be hoped other journals, but more especially those which are circulated largely amongst the public, will imitate the example set them, and boldly denounce the frauds which are being daily practised on us. In taking such steps these journals will not only benefit society, but will place a salutary and lasting check on the methods and practices which must seriously impede the advancement of one of our most important sciences. Unfortunately, however, the majority of newspapers aid and abet the electrical quacks by publishing their advertisements and reports of alleged 'wonderful cures.'" The only remark we desire to make on this expression of opinion from the *Hospital Gazette* is, that the Electrical Review is quite unconscious of the formation of any committee.

Street Names Read at Night.—It is said that the inspector of streets of St. Louis has adopted a novel method of marking the names of streets, so that the darkest night will not render the way difficult to find. The names of the streets are painted upon the electric light globes, and the shadow resulting throws the name upon the ground so plainly that it can be read 50 feet away. The letters on the globe are three-quarters of an inch, and the shadow is five feet wide. An arrangement of this nature would be a welcome one elsewhere.

Mr. Edison as a Medical Electrician.—The article which we print on page 213 shows Mr. Edison in a new character, one, indeed, in which we trust he may shine as brightly as he has hitherto done in the application of electricity to the industrial arts. The subject he has taken in hand is one of great importance, and will be duly appreciated by those who have suffered various degrees of torture from an excess of uric acid.

Submarine Cables.—The table of interruptions and repairs to submarine cables during 1888–1889, which we publish on another page, will be found of service to those interested in their manufacture, laying, and repair, as well as to the various telegraph companies. We expect that in the near future this table will be considerably elongated.

Electric Lighting Statistics in North America.—The following figures, which we cull from *Electrical Industries*, show to what enormous proportions the central station electric light industry has grown in North America. The number of stations is given as 1,379; the arc lamps in use as 137,441; the incandescents of 16 candle-power as 1,590,967; the engine capacity 356,755 H.P., and the capital invested as $118,758,500.

"Beneficent Murder."—The *D.T.* has thrown open its columns, and the subject now discussed in a general way is the death of Kemmler. Mr. Buchanan is holding forth against what he calls cowardly experiments.

Woodhouse and Rawson.—We are informed that Woodhouse and Rawson United, Limited, have been awarded a silver medal for their show at the Exhibition of Fire and Life saving apparatus now being held at Amsterdam.

Electricity and Ballooning.—Electrical motors for use in ballooning are being manufactured at the Meudon military workshops on the plan invented by M. Renard. The importance of the discovery is said to be such that the details are kept strictly secret, although probably this is a greatly exaggerated version of the real facts.

NEW COMPANIES REGISTERED.

Nonpareil Electric Syndicate, Limited.—Capital, £6,000, in £10 shares. Objects: To adopt an unregistered agreement of the 8th inst., between James Tarbottom Armstrong and Joseph Mason, of one part, and W. J. Smith (for this company), of the other part, relating to the purchase by the company of the letters patent granted to Joseph Mason for "a new or improved automatic coin-freed machine for giving electric shocks;" No. 1757, dated 11th October, 1889. Signatories (with one share each): J. Cunningham, 1, Maude Villas, Peckham; W. J. Smith, 29, Somerfield Road, N.; T. Sanders, 12, Dinsdale Road, Westcombe Park, S.E.; J. W. Jenner, 34, Millbank Street, S.W.; J. Willpress, 37, Hubert Grove, Stockwell; D. Capern, 139, Grosvenor Park, Camberwell; C. B. Woods, 37, Markham Square, Chelsea. Registered, 13th inst., without special articles, by A. R. Fowler, 2, Victoria Mansions, Westminster.

Gordon Electric Traction Syndicate, Limited.—Capital, £2,400, in £10 shares. Objects: To purchase the invention of John Gordon of a system of electric street car traction, provisionally protected, 5th May, 1890, No. 6,083. To purchase all future inventions of John Gordon suitable to the better application of the said invention. To develop the working of the invention, and in particular to carry on experiments at the works of Messrs. Merryweather and Sons, at Greenwich and elsewhere. Signatories: John Gordon, 13, Nettleton Road, New Cross, electrical engineer, 1 share; Wilhelm Luttge, 21, Lime Street, 14 shares; A. F. Koehel, 6, Fenchurch Street, 5 shares; J. C. Merryweather, Greenwich, 10 shares; E. Pascoe Williams, Blackheath, 10 shares; J. M. V. Money Kent, 34, Victoria Street, S.W., 10 shares; H. R. Goring, 17, Leadenhall Street, 10 shares. The signatories are the first directors, and Mr. Gordon is appointed managing director. Registered, 13th inst., by Gilbert Robins, 11, Pancras Lane.

Trujillo Railway (Peru), Limited.—Capital £500,000, in £1 shares. Objects: To acquire, construct, equip and maintain railways, tramways, telegraph and telephone lines in Peru, and to acquire the rights of the Peruvian Corporation, Limited, under any concessions or contracts relating to such means of communication. Also to construct electric lighting works, and to acquire, use, and provide steam, electrical, hydraulic or other power. Signatories (with 1 share each): C. L. Smiles, J. R. Yates, 15, Bedford Row; W. H. Rawle Judd, 33, Liverpool Street; N. G. Hill, 40, Counters Road, Kentish Town; T. J. Mason, 22, Lorrimore Road, S.E.; W. F. Symonds, Oak Lea, Lordship Lane; F. W. Binyon, Chichester Road, Croydon. The subscribers are to appoint the first directors. Qualification, £100 in shares or stock. Remuneration—chairman, £200 per annum; other directors, £150 per annum. Registered 14th inst. by Smiles, Ollard and Yates, 15, Bedford Row. Registered office, 66, Old Broad Street.

Vaughan Sherrin Electrical Engineering Company, Limited.—Capital £25,000, in £5 shares. Objects: To manufacture and supply electric motors, generators tricycles, bath-chairs, boats and machines, either wholly or partly propelled or worked by electricity upon any system whatever, and to carry on the business of electrical and mechanical engineers. Signatories (with 1 share each): E. H. Roberts, 85, Rushmore Road, Clapton; H. Floodgate, 123, Pall Mall; Henrietta Sherrin, 19, Duncan Terrace, N.; H. H. Paice, 81, Lydner Road, N.; J. H. Dempster, 59, Abbey Street, Bermondsey; T. J. Edwards, 18, Standard Street, Newington; Miss Ellen Mary Simmonds, 19, Duncan Terrace, N. Mr John Vaughan Sherrin is appointed managing director, at a salary of not less than £300 per annum. The minimum remuneration of the ordinary directors is £400 per annum. Registered 16th inst. by Lowless and Co., 26, Martin's Lane, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Thornebury Miner's Safety Lamp Company, Limited.—An agreement of 30th ult., filed 31st ult., between James Thorne, of 85, Gracechurch Street, and the company, is supplemental to an agreement of 30th April and to an agreement of 20th May. The latter of these provided for the allotment of 15,000 fully paid shares of £1 each in part payment of the sum of £25,000 as purchase price for the British patent, No. 2779, of 1889. The said shares have been allotted, and sums of £2,500 and £1,960 have been paid in cash, and there now remains £5,540, and in settlement of this amount the present agreement provides for the allotment of fully paid shares.

Dick, Kerr & Co., Limited (engineers, electricians and contractors for railways, tramways, and other undertakings).—An agreement of 31st May, filed 20th June, provides for the purchase of the business carried on by Frederick Mannelle and John Kerr at 101, Leadenhall Street and at Kilmarnock, Ayrshire, under the style of Dick, Kerr & Co. The consideration is £115,000, payable £35,000 in cash and £80,000 in fully paid shares. An agreement of 6th June confirms the above.

Allen, Everitt and Sons, Limited (metal manufacturers, wire drawers, and electrical engineers).—An agreement of 5th June, filed on the 17th June, provides for the purchase by the company of the business carried on by Allen, Everitt and Sons at the Stephenson Works, Birmingham, and in London. The purchase consideration is £223,000, payable £132,000 in cash, £26,000 in £5 per cent. debenture stock, £33,000 in fully paid £6 per cent. cumulative preference shares, and £32,000 in ordinary shares, credited with £8 as paid up.

Eastern and South African Telegraph Company, Limited.—At an extraordinary general meeting of the shareholders in this company, held at Winchester House on the 17th ult., the following resolution was passed: —"That Article 100 of the company's articles of association be altered by striking out therefrom the word 'inclusive,' and inserting in lieu thereof the word 'exclusive.'" The resolution was confirmed on the 1st inst., and duly filed on the 7th inst. The article referred to the directors' remuneration of £1,200, inclusive of the amount paid to the managing directors, but which now stands exclusive of such amount.

The annual return of this company, made up to the 31st ult., was filed on the 13th inst. The nominal capital is £600,000 in £10 shares, the whole of which are taken up and are fully paid.

Exeter Electric Light Company, Limited.—The annual return of this company, made up to the 5th inst., was filed on the 11th inst. The nominal capital is £20,000, in £10 shares; 915 shares are taken up, and upon 780 of these the full amount has been called, and £2 per share has been called upon two shares, the remaining 133 shares being considered fully paid up. The calls paid amount to £7,634, and unpaid to £186.

Electric Date and Time Stamp Company, Limited—The annual return of this company, made up to the 30th ult., was filed on the 11th inst. The nominal capital is £121,000, divided into 100,000 ordinary and 21,000 deferred shares of £1 each. There are 6,893 ordinary and 21,000 deferred shares taken up, 25,500 been considered fully paid. Upon 2,393 ordinary shares the full amount has been called, the calls paid amounting to £1,824 5s., and unpaid to £568 15s.

Column Printing Telegraph Syndicate, Limited.—At an extraordinary general meeting of this company, held at 5, New Bridge Street, on the 30th June, it was resolved :—"That the capital of the syndicate be increased to £25,000 by the creation of 300 new shares of £50 each." The resolution was confirmed on the 16th ult., and was duly filed on the 8th inst.

The annual return of this company, made up to the 12th of August, was filed on the following day. The nominal capital is £25,000 in £50 shares ; 171 shares are taken up, and of these 100 are considered as fully paid. Upon 71 shares £18 15s. per share has been called up and paid, the calls paid amounting to £1,331 5s.

Mutual Telephone Company, Limited.—At an extraordinary general meeting, held at the Memorial Hall, Albert Square, Manchester, on the 21st ult., the following special resolution was passed, viz. :—"That the articles of association of the company be altered in manner following : (*a*) In Article 99 the word 'ten' shall be substituted for the word 'six.' (*b*) The following article shall be substituted for Article 100, namely : 'The directors may, with the authority of the company in general meeting, take from the said reserve fund in any year such sum as the directors may think it desirable to apply towards payment of dividends on the shares, provided that in no case shall the dividends on the shares exceed 10 per cent. per annum on the amount paid up or credited as paid up thereon.'" The original Article 99 relates to the payment of dividends not exceeding 6 per cent. per annum, and Article 100 authorises the directors to take from the reserve fund such sum as may be required to make up 6 per cent. per annum dividend. The above special resolution was confirmed on the 7th inst., and was duly filed on the 11th inst.

Venezuela Telephone and Electrical Appliances Company, Limited.—The statutory return of this company, made up to the 29th ult., was filed on the 15th inst. The nominal capital is £70,000, in £1 shares, the whole of which are taken up. 56,756 shares are considered as fully paid, and upon 13,244 shares 15s. per share has been called up. The calls paid amount to £9,544, and unpaid to £389. Registered offices: 37, Lombard Street.

Institute of Medical Electricity, Limited. — The office of this company, formerly at 24A, Regent Street, is now situate at 35, Fitzroy Square, W.

Rastrick and Son, Limited (chemists, opticians, and electricians).—The registered office of this company is situate at 7, King's Terrace, Southsea.

CITY NOTES, REPORTS, MEETINGS, &c.

The Petroleum Engine Company, Limited.

The report of the directors, for the year ending June 30th, 1890, states that :—

The progress of the company during the past twelve months has not in some respects been so rapid as the directors could have wished, but it is hardly necessary to point out that in developing an entirely new motive power, time is required to establish sufficient confidence to secure orders freely from the general public.

The steady progress which has been made up to the present time is shown by the fact that the royalties received prior to June, 1888, amounted to £18, while the royalties received for the year ending June, 1889, amounted to £559, and the royalties received for the year ending June, 1890, amounted to £1,035.

Amongst orders recently received, many instances could be given where consulting engineers and others have been watching the working of the engine during the past 18 months before taking upon themselves the responsibility of recommending its adoption.

A considerable number of repetition orders have been received during the past 12 months, and an engine lately supplied represents the sixth order from the same purchaser.

The Priestman engine has recently been adopted by the Crown agents for the Colonies, the Norwegian and Egyptian Governments, and the Trinity House. The Northern Lighthouse Board, after making prolonged tests with three 5-horse-power engines supplied for a fog signal station, have given a further order for three engines of the same size for a second station.

The Royal Agricultural Society offered special prizes this year for light portable motors, arranged in two classes—firstly, for steam and hot air ; and secondly, gas and oil engines. The first and only award in the second class was given for the Priestman engine, and the *Times* newspaper of June 23rd says :—"The first prize of £30 was awarded to Messrs. Priestman Brothers, Limited, of Holderness Foundry, Hull, for their well-known portable oil engine, to whom we believe the silver medal of the society has already been awarded. This engine is most economical in working, costing less in this respect than any other motor in either class."

Mr. Alderman Bailey, ex-President of the Manchester Association of Engineers, who read an interesting paper on the subject of "Canal Boat Propulsion," after tracing the history of steam propulsion from the first application of steam in 1799 down to the present time, adds :—"The Manchester Ship Canal Company, for the Bridgewater narrow canal, has recently purchased two Priestman's patent double-cylinder 10 horse-power vertical oil engines, with bevelled wheels, frictions, shafting, bearing, propeller shafts, stern tubes, and propellers. The engine was guaranteed to work with an expenditure of oil not exceeding 13¾ pints per hour. On trial trips made, the expenditure was 10 pints per hour."

It is satisfactory to note many facts which indicate that the habitual distrust of new mechanical and scientific inventions is gradually yielding to the numerous demonstrations of the complete adaptability of the Priestman oil engine to the diverse purposes for which it has been brought into actual use, and a progressive increase of sales is confidently anticipated.

The amount of royalty paid by the licensees during the 12 months does not by any means represent the royalty on the whole of the engines sold up to the 30th of June last, as by the terms of the agreement, royalty is only payable to your company after the engine itself has been paid for.

The income and expenditure account shows a balance in favour of the company of £440 14s. 7d., which the directors recommend shall be carried forward to next year's account.

The retiring directors are Messrs. Henry Pawson and Ernest Moreton, who offer themselves for re-election. The secretary has received a notification from Mr. Septimus Gibbon, of 36, Finsbury Pavement, London, E.C., that he intends to offer himself as a director.

General Electric Company.

The statutory general meeting of the shareholders of the General Electric Company, Limited, took place on Tuesday at the offices, 71, Queen Victoria Street.

Mr. Gustav Binswanger (the chairman of the company), who presided, stated that the business of the company was divided into three departments—electric lighting, electric bells, and the works at Manchester. The result of the trading was that they were able to recommend a dividend of 15 per cent. on the preference shares, and of 7½ per cent. on the ordinary shares, carrying, at the same time, a sum of £637 to reserve. This result must be considered extremely satisfactory, inasmuch as the earning power of the company upon the actual capital invested was more than 25 per cent. per annum. The business was continuing to show a very substantial increase, and as the winter was the best time for a business of this description, they had every prospect of being able to double the returns. The chairman concluded by moving the adoption of the report and accounts.

Mr. Myerstein seconded the resolution, which was unanimously agreed to, and the dividends as recommended were also declared.

Mr. T. J. Seel was re-elected auditor of the company.

Mr. Hess proposed, and Mr. Goldschmidt seconded, a vote of thanks to the chairman and directors, and the meeting separated.

TRAFFIC RECEIPTS.

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending August 15th, after deducting the fifth of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited, were £3,718.

SHARE LIST OF ELECTRICAL COMPANIES.

Present Amount Issued.	Name.	Stock or Share.	Closing Quotation. (August 15).	Closing Quotation. (August 21.)	Business done during week ending August 21, 1890.	
£					Highest.	Lowest.
250,000	African Direct Telegraph, Ltd., 4 p. c. Deb. Regd. and to Bearer	100	97 —100	97 —100		
1,549,160	Anglo-American Telegraph, Limited	Stock	49½— 50½	50½— 51½	51	49⅝
2,725,420	Do. do. 6 p. c. Preferred	Stock	85 — 86	87 — 88	88	86⅜
2,725,420	Do. do. Deferred	Stock	13¾— 14¼	14¾— 15¼	15⅛	14
130,000	Brazilian Submarine Telegraph, Limited	10	11¾— 12¼	11¾— 12¼	12⅛	$11\frac{15}{16}$
99,000	Do. do. 5 p. c. Bonds...	100	100 —102	100 —102		
75,000	Do. do. 5 p. c. 2nd Series, repayable June, 1906	100	103 —107	103 —107		
63,416	Brush Electric Engineering Ordinary, Nos. 1 to 63,416... ..	3	1½— 2	1½— 2		
63,416	Do. do. Preference, Nos. 1 to 63,416 ...	2	1½— 2	1½— 2		
$7,216,000	Commercial Cable, Capital Stock	$100	103 —105	103 —105	105	103¼
224,850	Consolidated Telephone Construction and Maintenance, Ltd. ...	14/-	$\frac{9}{16}$— $\frac{11}{16}$	$\frac{9}{16}$— $\frac{11}{16}$		
20,000	Crompton & Co., Limited, 7 p. c. Pref. Shares, Nos. 1 to 20,000	Stock	5¼— 5¾	5¼— 5¾		
16,000	Cuba Telegraph, Limited	10	12½— 13½xd	12½— 13 xd	12½	...
6,000	Do. do. 10 p. c. Preference	10	16½— 17½xd	16½— 17½xd		
12,931	Direct Spanish Telegraph, Limited ... (£4 only paid)	5	3½— 4	3½— 4	$3\frac{15}{16}$	...
6,000	Do. do. 10 p. c. Preference	5	9 — 10	9 — 10		
60,710	Direct United States Cable, Limited, 1877	20	10⅛— 10⅜	10⅛— 10⅜	10½	10¼
400,000	Eastern Telegraph, Limited, Nos. 1 to 400,000	10	13⅞— 14⅛	13⅞— 14⅛	14⅛	13⅞
70,000	Do. 6 p. c. Preference	10	15 — 15½	15 — 15½	15	...
200,000	Do. 5 p. c. Debs. (1879 issue), repay. Aug., 1899	100	106 —109	106 —109	107⅞	...
1,200,000	Do. 4 p. c. Mortgage Debenture Stock	Stock	106 —109	106 —109	108	107
250,000	Eastern Extension, Australasia and China Telegraph, Limited	10	14 — 14¼	14 — 14¼	$14\frac{3}{16}$	$14\frac{1}{16}$
320,000	Do. 6 p. c. Debentures, repay. February, 1891	100	100 —102	100 —102	100½	...
446,100	Do. 5 p. c. (Aus. Gov. Sub.), Deb., 1900, red. ann. drgs. ...	100	103 —106	103 —106	104½	
12,500	Do. 5 p. c. Debentures, 1890, redeem. ann. drawings ...	100	103 —106	103 —106		
367,900	Eastern and South African Tel., Ltd., 5 p. c. Mort. Deb., 1900...	100	100 —103	100 —103	102	101
19,900	*Electricity Supply Co. of Spain, Nos. 101 to 20,000	5	4¾— 5¼	4¾— 5¼		
46,700	Elmore's Patent Copper Depositing, Ltd., Nos. 23,001 to 70,000	2	5¼— 5¾	6 — 6½	6⅛	$5\frac{11}{16}$
19,700	Fowler-Waring Cables, Nos. 301 to 20,000 ...(£3 only paid)	5	2 — 2½	2 — 2½		
180,227	Globe Telegraph and Trust, Limited	10	8⅞— 9⅛	8⅞— 9⅛	9⅛	$8\frac{15}{16}$
180,042	Do. do. 6 p. c. Preference	10	14⅞— 15⅛	14⅞— 15⅛	14⅞	14¾
150,000	Great Northern Tel. Company of Copenhagen	10	15½— 16	15½— 16	$15\frac{15}{16}$	15¾
40,000	Do. do. 5 p. c. Debs. (issue of 1881) ...	100	100 —103	100 —103		
250,000	Do. do. do. (issue of 1883) ...	100	106 —109	106 —109	106	...
9,334	Greenwood and Batley, Ltd., Ordinary, Nos. 4,667 to 14,000 ...	10	12 — 13	12 — 13		
5,334	Do. 7 p. c. Cumulative Preference, Nos. 2,667 to 8,000	10	11½— 12½	11½— 12½		
41,600	India-Rubber, Gutta-Percha and Telegraph Works, Limited ...	10	18½— 19½	18½— 19½	$18\frac{9}{16}$	18½
200,000	Do. do. 4½ p. c. Deb., 1896...	100	102 —104	102 —104		
17,000	Indo-European Telegraph, Limited...	25	37 — 39	37 — 39		
38,348	London Platino-Brazilian Telegraph, Limited	10	6 — 7	6 — 7		
100,000	Do. do. do. 6 p. c. Debentures ...	100	107 —110	107 —110	109	...
49,900	*Metropolitan Electric Supply, Limited, Nos. 6,101 to 50,000 ...	10	4 — 4½	4 — 4½	$4\frac{3}{16}$	4⅛
436,700	National Telephone, Limited, Nos. 1 to 436,700	5	4⅞— 5⅛	4¾— 5	$5\frac{1}{16}$	$4\frac{13}{16}$
15,000	Do. 6 p. c. Cum. 1st Preference	10	12¼— 12¾	12 — 12½	$12\frac{7}{16}$	...
15,000	Do. 6 p. c. Cum. 2nd Preference (£8 only paid)	10	10 — 10½	10 — 10½		
220,000	Oriental Telephone, Ltd., Nos. 80,001 to 300,000 (11/- only paid)	1	¼— ⅜	¼— ⅜		
9,000	Reuter's, Limited	8	7¾— 8¼	7¾— 8¼		
209,750	South of England Telephone, Ltd., Ordinary, Nos. 1 to 2,000, 2,501 to 3,500, 93,251 to 300,000	1	¼— ½	¼— ½		
20,000	Do. 6 p. c. Cum. Pref., Nos. 1 to 20,000 (£3½ only paid)	5	2½— 3	2½— 3		
3,381	Submarine Cables Trust	Cert.	113 —117	113 —117		
78,949	Swan United Electric Light, Limited ... (£3½ only paid)	5	5 — 5½	5 — 5½	5⅛	5
37,350	Telegraph Construction and Maintenance, Limited	12	42 — 44	42 — 44	43¼	42
150,000	Do. do. do. 5 p. c. Bonds, red. 1894	100	100 —102	100 —102		
55,000	United River Plate Telephone, Limited	5	3½— 4½	3½— 4½	3½	...
146,000	Do. do. 5 p. c. Debenture Stock... ...	Stock	90 — 94	90 — 94		
100,000	Do. do. 7 p. c. Debs., Nos. 1 to 1,000 ...	100	... ...	... ...		
15,609	West African Telegraph, Limited, Nos. 7,501 to 23,109	10	9 — 10	9 — 10		
300,000	Do. do. do. 5 p. c. Debentures	100	100 —103	100 —103		
30,000	West Coast of America Telegraph, Limited	10	4 — 5	3 — 5	4⅛	3¼
150,000	Do. do. do. 8 p. c. Debs, repay. 1902 ...	100	106 —110	106 —110	106	...
64,572	Western and Brazilian Telegraph, Limited	15	10¾— 11¼	11¼— 11¾	11⅝	11¼
26,986	Do. do. do. 5 p. c. Cum. Preferred	7½	6½— 7	6¾— 7¼	6⅞	6¾
26,986	Do. do. do. 5 p. c. Deferred	7½	4 — 4½	4¾— 5¼	5⅛	4⅜
200,000	Do. do. do. 6 p. c. Debentures "A," 1910...	100	103 —106	103 —106		
250,000	Do. 6 p. c. Mort. Debs., series "B" of '80, red. Feb., 1910	100	101 —104	101 —104		
88,321	West India and Panama Telegraph, Limited	10	2¾— 3	2¾— 3	2⅞	$2\frac{13}{16}$
34,563	Do. do. do. 6 p. c. 1st Preference ...	10	11¼— 11¾	11¼— 11¾	11½	$11\frac{5}{16}$
4,669	Do. do. do, 6 p. c. 2nd Preference ...	10	13 — 14	13 — 14		
1,336,000	Western Union of U.S. Tel., 7 p. c. 1st Mort (Building) Bonds	$1,000	120 —125	120 —125		
179,300	Do. do. 6 p. c. Sterling Bonds	100	99 —101	99 —101		
42,853	*Westmstr. Elec. Sup. Corp., Ord., Nos. 101 to 42,953 (£2 only paid)	5	1¼— 1¾	1¼— 1¾		

* Subject to Founders Shares.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

Blackpool Electric Tramway Company, Limited, £10 (£6½ paid), 7⅛—7⅝.—Electric Construction Corporation (£10 paid), 7¾—8¼ Elmore Copper Depositing Priorities, 7 —7½.—Elmore Wire, ¼ dis—par.—House-to-House Company (£5 paid), 5 —5½.—International Okonite, Ordinary of £10 (£4 paid), 3¾—4¼.—London Electric Supply Corporation, Ordinary (£5 paid), 1⅞—2⅛.—Manchester Edison and Swan Company, £9 (£1 paid), 11/- —13/-.

BANK RATE OF DISCOUNT.—4 per cent. (21st August, 1890).

ELECTRICALLY HEATED TREVELYAN INSTRUMENTS THAT CAN BE USED AS MICROPHONES.

By A. M. TANNER.

IN my researches concerning the uses of carbon for electrical purposes I was at once struck with the great similarity certain types of Trevelyan instruments bear to the microphone, or that form of telephonic instrument, in which loose contacts of solid or hard carbon are employed for regulating the tension of the current in a closed electric circuit.

In Poggendorff's *Annalen der Physik und Chemie*, for Vol. 104, page 413, appears an article by Paalzow concering some phenomena of motion in the closed circuit of a galvanic battery. It is here stated "that when a thin sheet of platinum is placed upon a copper plate that is connected with one pole of a battery of four Bunsen elements and a piece of carbon in the form of a half ring is placed upon the sheet of platinum, a cavity in the free end of the carbon receiving a drop of mercury, then a regular rocking motion of the carbon takes place when a platinum wire led into the mercury is connected with the other pole of the battery. The arrangement of parts for carrying out the experiment is illustrated by fig. 1, in which *a* is the copper plate, *b* the sheet of platinum, and *c* the carbon.

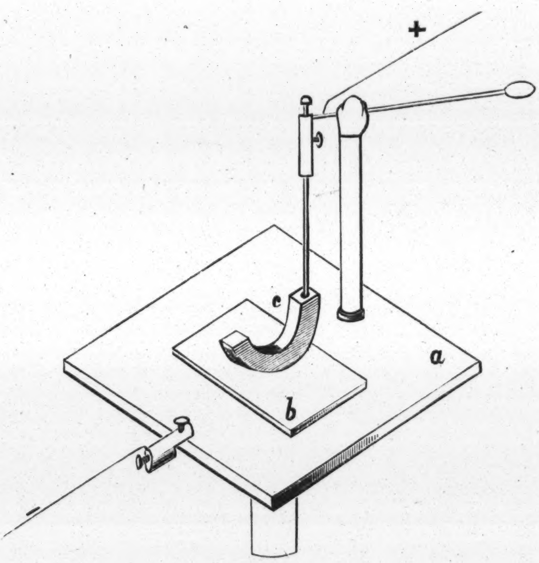
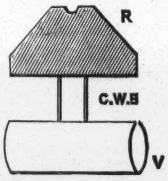


FIG. 1.

From experiments to determine the most favourable presentation of this phenomenon it was at once ascertained that sheet platinum such as is ordinarily used in Grove batteries, was best adapted for the purpose, and that very thin sheet brass and copper caused the phenomenon to appear in a weaker form, while the thinnest plates of other metals did not show it at all. When the metals were soldered to a copper plate of considerable thickness, then in the case of platinum the vibratory motion of the rocker was observed after the latter had remained a long time upon the platinum and sparks had passed. The rocker must be made of carbon of good conductivity such as is used in Bunsen elements and for the production of the electric light; wood carbon was not moved at all. Simultaneously with the movement of the rocker the passage of sparks between the carbon and platinum plate was observed, and when the motion of the rocker grew so violent that the platinum wire passed out of contact with the mercury, sparks were also observed between the platinum wire and mercury. Before the rocking took place, an elevation of the carbon always occurred, as if it were attracted by the platinum wire, and frequently there was only an elevation of the carbon and no regular movement at all."

After the foregoing description, the experimenter discusses the probable cause of the rocking motion of the carbon, and says it cannot be attributed to repellant action; experiments disproved this theory, since the rocking movement did not take place with all metals. Then it is stated that it might also be due to the passage of the spark between the carbon and platinum which caused a hurling of the carbon particles with such a force as to produce the working movement; this theory was, however, also disproved by experiments.

Then Paalzow continues and says: "It can be shown, however, that the heat which is developed at the contact point by the passage of the spark, produces a change of form of the platinum plate, which necessarily must cause a movement of the carbon. When the rocker, or even a flat surfaced piece of carbon was placed on the platinum, then a raising of the edges of the platinum was observed during the passage of the spark." Paalzow then arrives at the conclusion "that at the point where the platinum is nearest the carbon, a spark passes across, and at the same time an unequal heating and change of form of the platinum takes place, so that the carbon is thrown out of balance, whereupon the passage of the spark is transferred to some other point, followed by another movement of the platinum and carbon. If the platinum surface is even, then the passage of the spark will take place where the carbon presses the platinum with the most force, so that upon the change of position of the carbon, the passage of the spark must again take place where the carbon touches the platinum. In Poggendorff's *Annalen*, vol. 105, page 620, Rollman calls attention to the fact, that as early as 1850, he described a Trevelyan instrument, moved by the galvanic current, in the *Jahresberichte des naturwissenschaftlichen Vereins in Halle*, page 189. This journal, consulted by me, states that it is known that the Trevelyan instrument is operated by the heating of the "rocker" or the "bearer." If both are allowed to remain cold, the sound can also be produced by passing a galvanic current through the instrument. The explanation is easy. The current will not produce a perceptible raising of the temperature of the massive rocker or bearer, but will cause a heating at the two points where they touch each other. What follows can be easily understood. I obtained sounds with bearers and rockers made of copper, and with a brass rocker and iron bearer connected with two Bunsen or Grove elements. The idea of operating the instrument in this manner is due to Prof. Hankel." In the article in Poggendorff's Annalen, Rollman says that all materials that are good conductors of electricity may serve for the carrier and rocker, provided the proper shape is given them at the contact points. Then he says that he experimented with rockers of brass, steel and *gas carbon*, and maintained the same in a state of permanent vibration upon bearers of gold, platinum, silver, copper, brass, nickel, German silver, iron, steel, zinc, cadmium, tin, lead, antimony, wismuth, aluminium and *gas carbon.*



R, rocker; C.W.B., copper wire bearers; V, vice.

FIG. 2.

Referring to the carbon rocker he says it was a roughly cut piece of gas carbon of a prismatic form (6 inches long, 1 inch wide and 1½ inches thick), provided with a handle. The bearers were by reason of the form of the rocker worked out into *points* and stretched in a screw clamp as was already done by Tyndall and Seebeck.

In order that this paragraph of Rollman's description can be easily understood, I have consulted the published experiments of Tyndall and Seebeck, concerning vibrations and tones produced by the contact of bodies having different temperatures. It may be well to state here that neither proposed the use of carbon rockers and bearers. Tyndall's experiments are found described in the London, Edinburgh and Dublin Philosophical Magazine for 1854, vol. 8, page 1-12. Among other forms of rockers he describes one of a prismatic form, supported by its flat side on two pointed copper wires stretched in a vice (fig. 2).

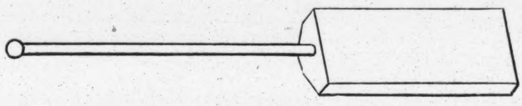


FIG. 3.

Tyndall also shows this form of rocker provided with a handle (fig. 3).

Seebeck's experiments are described and illustrated in Poggendorff's Annalen, vol. 51, page 1. The following are some of the forms of bearers and rockers used by him (fig. 4).

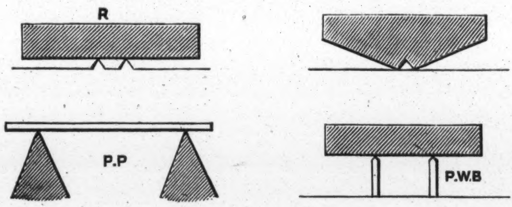


FIG. 4.

R, rocker; P, P, pyramidal points; P W, B, pointed wire bearer.

It will thus be readily seen what Rollman means when he speaks of "carbon bearer points stretched in a screw clamp and supporting a carbon rocker of prismatic form." Continuing Rollman's description of his instrument, he says "that the handle of the rocker rested upon a second suitable support, and to its end was soldered a wire which dipped into mercury, so that the current could easily be led through the carrier and rocker." As the source of electricity, he always used a single zinc-iron element. Frequently the vibrations obtained were slow, so that they could be easily counted; at other times they followed each other so rapidly as to run together into more or less high tones, The rapidity of the vibrations is chiefly due, as appears to me, to the distance of the bearer points, the weight, the shape, and the position of the centre of gravity of the rocker, and, finally, to the heating and expansion of the contact surfaces. No sparks appear at the two contact surfaces between the bearer and rocker, as the *contact is never broken there.* A slight spark is, of course, imperceptible to the eye, but its absence was ascertained by the polished brass rocker, which never showed the slightest trace of oxidation. The same thing was also proved by the galvanometer; when a portion of the current was by a branch wire led into the same, and the needle hardly went back, when the rocker, which had previously rested quiet, was lightly struck. The slight weakening of the current shown by the galvanometer is explained by the increase of resistance, because during vibration the rocker rests generally only upon one point and only rests momentarily upon both points when it falls upon the other side.

In view of the importance of this last paragraph, it disclosing the variable contact principle of the microphone, it is best to give it also in the original, viz.:—Die durch dies en Rück gang (of galvanometer) angezeig te geringe Schwäehung des Stromes erklärt sich aber durch die Vermehrung des Leitungs widerstandes da berin Tönen der Wieger meist áuf einer Spitz e schwebt und nur wenn er auf die andere Seite fällt momentan auf beiden Spitzen ruht.

Rollman in commenting upon Paalzow's statement concerning the operation of his instrument, says that if sparks were shown between the carrier and rocker, it must be attributed to the heavier current (Paalzow used 4 platinum elements), and, on the other hand, to the lighter piece of carbon, although it is not probable that *even in his case the contact was ever completely broken.*

It is not contended by the writer that the foregoing references disclose the principle of varying the strength of a battery current in unison with the rise and fall of vocal utterances or sound waves; but it is unquestionably true, that Rollman constructed an instrument for giving out sound, in which the variation of the electrical resistance was attained by two loose contacts of solid carbon under different degrees of contact pressure, effected by the passage of the current itself, and not by sound waves. In connection with the principle set forth by Rollman, that two loose carbon contacts will by change of position vary or modify the current in a closed electric circuit, it is well to refer to Stroh's experiments with carbon contacts in microphones, described in the London *Electrician* for April 28th, 1883. It is here stated that "it also appears evident that a current crossing a microphonic contact, has a strong tendency to cause vibratory disturbances, and it seems, therefore, reasonable to suppose that during microphonic action, even when all is in good adjustment, the sound waves which are transmitted are accompanied by other vibrations which are due to the passage of the current itself."

As the Trevelyan instruments of Paalzow and Rollman have a loose contact piece of carbon bearing lightly upon another contact piece of platinum or carbon and are to be used in a close galvanic circuit, it is self-evident from the close resemblance these instruments bear to microphones, that they can be used for telephonic transmission when combined with a proper receiving instrument.

The "half ring-shaped carbon contact" found in Paalzow's instrument, can be made to operate in the same manner as the carbon spheres and loose gravitating cylinders used in certain types of microphones or carbon transmitters, and the very instrument described and illustrated by Paalzow, will undoubtedly serve as a microphone transmitter, when used in connection with a battery current, not too powerful to cause sparking. As to Rollman's instrument, in which a carbon prism is supported upon carbon rods or bearers, it will be seen that it strongly resembles the instruments used by Professor Hughes in carrying out his experiments "on the action of sonorous vibrations in carrying the force of an electric current," first described in the *Proceedings of the Royal Society* for 1878, page 362.

Rollman's discovery can well be defined as the action of a vibrating solid carbon body for varying the force of an electric current in a closed circuit.

THE INFLUENCE OF ELECTRIC RAILROADS UPON TRANSATLANTIC TELEGRAPHY.*

By CHARLES CUTTRISS, Electrician Commercial Cable Company.

IT would hardly seem possible that the two above-mentioned industries could in any way clash, but the following account of trouble traced directly to an electric railroad will show that they do so, and that ultimately difficulties may arise which will have a serious effect upon transatlantic telegraphy, and unless some remedy is found, we may possibly have to resort to a less speedy communication between the two countries.

For many years it was the practice of cable companies to pick out some quiet, secluded spot in which to land their cables and to use land lines for the remaining distance to the nearest important city, using it as a radiating centre. This plan necessitated one transmission or repetition more than was actually necessary, and also caused a loss of time which it was very desirable to save. The Commercial Cable Company was the the first to make an innovation, and in order to give quicker communication decided to land their sea cable at Coney Island, and continue it with an underground cable through Ocean Avenue and Brooklyn into the heart of this city, thereby practically making the terminus of their cable in Wall Street. Past experience had shown the advisability of using a return earth circuit as far as the sea, so the underground cable was constructed with four cores laid up in the usual manner and only separated from one another by about $\frac{1}{32}$ of an inch.

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* *Electrical Engineer,* New York.

The cable proper is connected to one of the cores by a permanent sea joint, and the diametrically opposite core, which is used as the return earth to the sea, is soldered directly to the sheathing wires of the sea cable, and the other two cores are kept spare in case of trouble.

This plan has given the utmost satisfaction until within the last few months, when we began to experience some trouble from occasional kicks on our receiving instrument; sometimes they would be so strong as to obliterate a signal. As these kicks are nothing unusual during the summer months, owing to thunderstorms and other atmospheric disturbances, they were for some weeks attributed to such causes.

During this period it was also noticed, when testing the cable, that the mirror seemed to be very unsteady, and had erratic movements, which denoted by their abruptness that the cause of disturbance was near this end of the cable, and was such as might be produced by a small fault.

To satisfy myself on this point I had the cores cut at the cable house on Coney Island, and while I was testing the undergrounds, the electrician at Canso, Nova Scotia (the distant end of the cable), was also testing the sea cable. The results showed that both the undergrounds and the cable were in perfect condition, but it was observed on the undergrounds that there was some disturbing cause in their neighbourhood; as, after perfectly discharging the cores, they would in a few seconds become quite heavily charged, always with the same potential; this phenomenon, of course, was only remarkable in the degree of charge. So far, we had arrived at only negative results, as the kicks, &c., were still present on joining up the working instrument.

About this time it came to my knowledge that there had recently been an electric railroad established, running from Prospect Park, Brooklyn, to Coney Island by way of the old Coney Island horse car road. Immediately it occurred to me that here possibly was the source of trouble. It must be remembered that ocean cables are operated by a recording instrument, that is so sensitive that a current of $\frac{1}{1000}$th of a milliampère will produce a distinct working signal; hence it is quite conceivable that, although the electric road does not in any part of its route approach our underground cables nearer than about *half a mile*, disturbances might be produced by the ever-varying power used in starting and running the cars. To prove the correctness of the assumption, I connected a telephone between the cable and its return earth and could distinctly hear the starting and stopping of the cars. The telephone was then connected to the cable and a local earth in the city, namely, the water pipes; the sounds then became so much louder that they could be heard with the telephone a short distance from the car. The testing galvanometer, a Thomson astatic, of course could not pick up such rapid vibrations, but it shows deflections and kicks to such a degree that we have sometimes been obliged to give up testing and try at a more favourable time, such as 1 or 2 a.m., when the cars have stopped for the night. This naturally is somewhat inconvenient.

Now comes the question, if the disturbance is so severe with the railroad at a distance of half a mile or 2,640 feet, what would be the effect on the company's property if at some time an electric road should be projected down Ocean Avenue where the rails would in all probability be within 4 or 5 feet of the cable for a minimum distance of 5½ miles? With telephones and ordinary telegraph instruments the use of a metallic circuit is a good protection, but in the present case it is proved that a metallic circuit through the disturbed district does not grant immunity from serious disturbance.

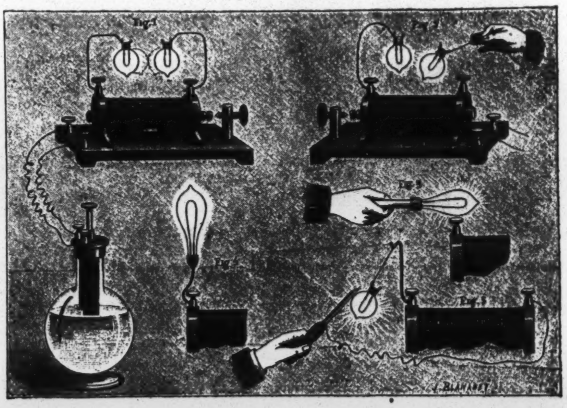
One point is still to be determined in regard to this phenomenon, namely, to ascertain for a certainty whether the effects produced are to be attributed to conduction through the earth and water to our armouring, or if it is an inductive effect. The fact, nevertheless, remains that if electric roads should be greatly augmented in our immediate vicinity the disturbances on our lines will be seriously increased, and at present it is difficult to conceive of any remedy other than the adoption by the roads of a double trolley system.

The tests show our undergrounds to have a dielectric resistance of about 350 megohms per mile, so the idea of any leakage cannot be entertained.

EXPERIMENTS WITH ELECTRICITY.

WE, says *La Nature*, have received from a subscriber in Mexico a highly interesting description of some experiments with the Rhumkorff coil and incandescent lamps. These have been repeated by us at the laboratory attached to the Halles electric station, and we are now in a position to lay them before our readers, together with some hints of a practical nature.

By attaching two curved wires, each supporting an incandescent lamp, to the terminals of the secondary circuit of a Rhumkorff coil (fig. 1), we observe an approximation of the two lamps at the moment of the current's passing. The phenomena is particularly marked at a distance between the lamps of 3 to 5 millimetres. Care must be taken that the supports shall be very flexible, and for this purpose a copper wire, 1 millimetre in diameter, and insulated with gutta-percha, will be found perfectly suitable. It is likewise important to avoid direct sparks between the lamp sockets. It is necessary to the attraction that there should be a discharge traversing the lamps and compelling the approximation. By suspending one of the lamps (fig. 2) and holding the other in the hand, the attraction between them will be the same. A lamp placed upon a terminal of the secondary circuit of a Rhumkorff coil (fig. 3) will become luminous, and it will be only necessary to approximate a lamp to a terminal to obtain gleams of equal brilliancy (fig. 4); suspend a lamp by a flexible wire at one terminal (fig. 5) and approximate to it any point in connection with the other terminal, and an attracted and sustained gleam will be observable. These experiments may be varied at will; those above-described are intended as examples merely.



THE SOUTHEND PIER ELECTRIC TRAMWAY.

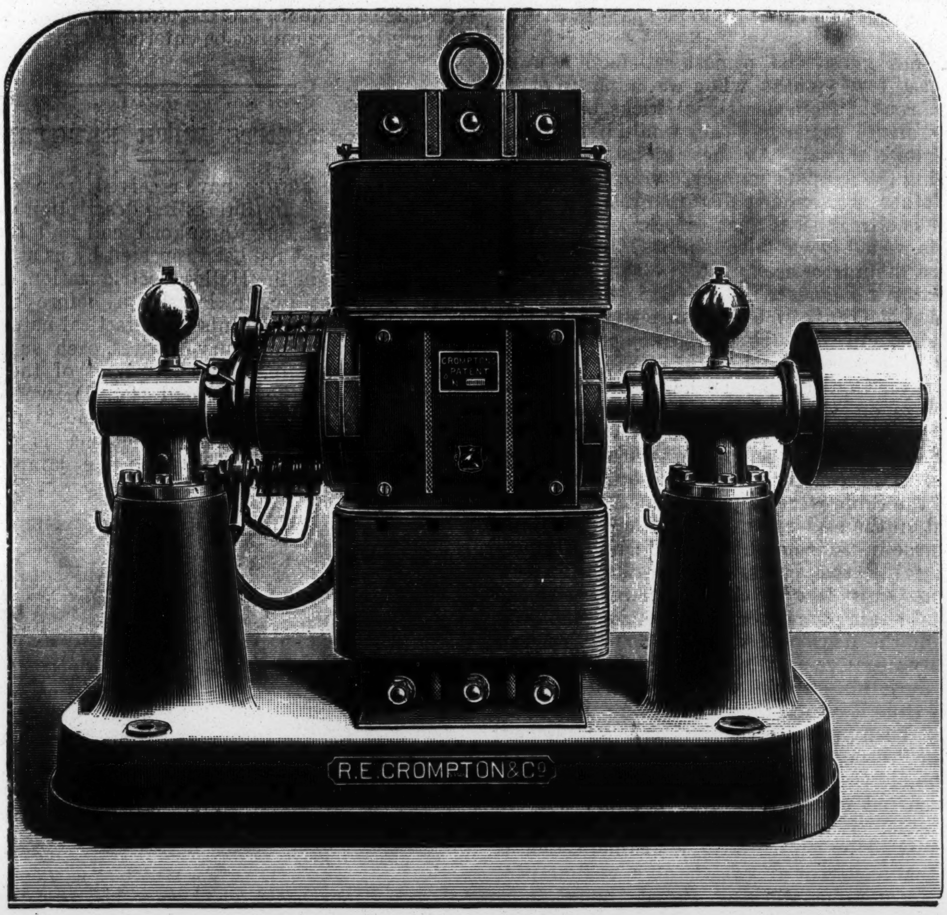
ELECTRICAL traction in this country is making slow but sure progress. Although engineers on this side have been confined to the development of underground systems of conductors, or to the use of accumulators, in neither of the latter two cases has sufficient success been hitherto attained in England to sufficiently attract the public attention to the manifold advantages which any system of electrical haulage presents.

It is therefore with pleasure that we notice an extremely successful addition to the few electrical tramways now being worked in this country, and to the opening of which we have already briefly alluded. The Southend Local Board, which is a very enterprising public body, and has introduced a large number of local improvements with a view of further popularising the already rapidly increasing town of Southend, has recently constructed a new iron pier, costing about £80,000, to replace the old wooden one, which was itself one of the most remarkable constructions of the kind in the country, being a mile and a quarter long, and fitted with a horse tramway. The board decided to replace horse traction on the new pier by an electric tramway, and after specifications had been issued, Messrs. Crompton secured the contract in public competition. One feature of this contract was the short period in which it had to be carried out, namely, that a length of three-quarters of a mile, with an electrical tramcar, and all the plant, as well as the lighting of the pier, should be completely set to work on the day previous to the August bank holiday, in order that the traffic might be secured for the new tramway.

This only gave the contractors six weeks in which to lay the track and supply all the generating machinery and build the car, motor, &c. By good management and a willing staff, they were fortunate enough to succeed in carrying out their contract one day within the time, and extreme credit is due to everyone concerned, particularly to Mr. Chamen, the chief of their outdoor staff, and to Mr. Scott Moncrieff, who is resident at Southend, for the extraordinary rapidity with which the work has been carried out, without a hitch or alteration in the original design.

The generating plant consists of a horizontal compound engine by Davey Paxman, supplied with steam by a boiler of locomotive type. Both are extremely favourable examples of the highly economical and extremely efficient class of steam engine that this well-known firm is now turning out. This engine drives a Crompton compound dynamo of their standard type, having an output of 150 ampères by 200 volts at the terminals, and having a commercial efficiency exceeding 90 per cent. The electrical energy is conducted from the engine room by insulated cables carried along the pier to the commencement of the car track, and from thence to the end of the pier. Messrs. Crompton determined to use their stock pattern flat strip copper conductor that they have been using for the past four years in the streets of London, the whole of the supports, insulators, and straining gear being taken from the stock, and identical in all respects with those they have used in upwards of 30 miles of streets in Belgravia, Kensington, and Notting Hill. The strip used in this instance is an inch wide by ·134 inch thick, and is supported at intervals of 15 yards by vertical insulators, and strained in lengths of 85 yards by straining gear having volute springs, to compensate for expansion due to differences of temperature, the insulators in both cases being the stock pattern used for street mains.

The track consists of a pair of Vignoles rails 3-inch

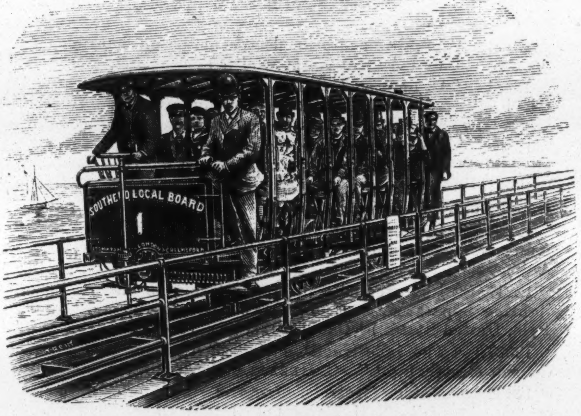


CROMPTON DYNAMO FOR GENERATING CURRENT.

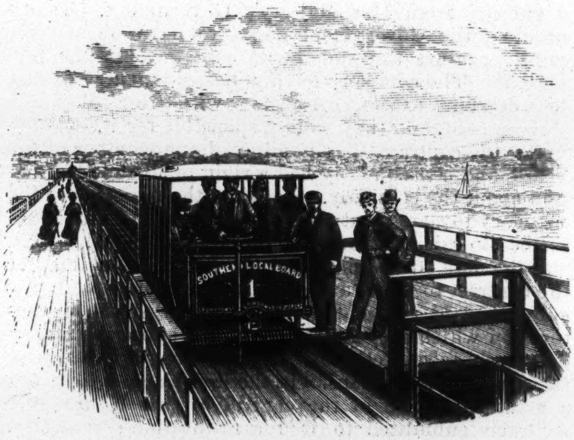
by 6-inch gauge, the strip conductor being laid about one foot distant from one of the rails, and one inch below the level of the rail tops. The rails themselves are used for the return. The car was built for Messrs. Crompton's order by Messrs. Kerr Stuart, and the motor is a stock pattern Crompton dynamo, the speed being reduced 3 to 1 by simple spur gearing. The motor is fixed below the bottom of the car, and access can be given to it either by bringing the car over the pit or by lifting a trap in the flooring. The car is driven from either end, and the means of regulation are extremely simple. A pair of handles, one for reversing and one for starting, with the ordinary brake wheel in front of the driver, being all that is required.

The maximum speed of the car is 20 miles an hour, but in ordinary running the speed is kept down to about 12 to 14 miles an hour, so that the journey along the pier, which used to occupy previously about 15 minutes, is now performed in three to four minutes. The contact apparatus for taking the current through the strip consists of rubbing shoes, especially designed for this purpose by Mr. Chamen, and which appears to act very well, and without apparently causing any wear to the surface of the copper strip.

An official trial was made by Dr. Hopkinson, consulting engineer to the Local Board, on the 30th of July. He expressed himself completely satisfied with the workman-like manner and extreme celerity in which the work had been carried out, and the members of the Local Board, and the townspeople generally, have over and over again expressed their extreme satisfaction with the unexpectedly rapid completion of the work, and its great success. The day following the official trial the car was handed over to the Local Board for regular running, and has been running ever since without breakage or interruption of any kind. On Bank Holiday the car was overloaded every journey, and the takings amounted to upwards of £40, and ever since that day the takings have been heavy.



CAR.



END VIEW OF CAR ¾ MILE UP PIER.

It is evident from this that the Southend authorities have made a good investment of the local funds in introducing this electrical tramway. The horse-power absorbed in driving a loaded car at full speed appears to be considerably below what Messrs. Crompton estimated it would be.

As soon as the pressure of public traffic of this season is over, Messrs. Crompton hope to be able to make a set of experiments to show what is the real tractive force required on this class of electrical railway, and intend to make these results public.

The Electric Light in Paris.—The right side of the Rue Auber, from the Rue Scribe to the Boulevard Haussmann, is now lighted by electricity. The arc lamps have been placed in the old gas lamps in the same way as at the Palais Royal.

PARLIAMENTARY NOTES.

TELEGRAPH CLERKS.

IN the House of Commons last Friday night, in answer to Mr. MacNeill,

Sir H. **MAXWELL** said: Mr. Quin, lately employed as a telegraph clerk at the central office, was dismissed for using the telegraph wire for private purposes, to the hindrance of public messages. Neither was the object with which he used the wires calculated to bespeak a lenient view of his conduct. Having formed one of a deputation to his controller, which pledged itself to a particular line of action, he had no sooner left the room than he proceeded to the telegraph wires and advocated another. Thus persons at a distance were stirred up by him to adopt the very course which the deputation, of which he was a member, had just assured the Department would not be adopted. For this act of duplicity, added to his infraction of a rule to which the Department attaches the highest importance, that the public wires shall not be used for private purposes, there was, in the Postmaster-General's judgment, only one suitable punishment, and that was dismissal. Mr. Quin's conduct inside the office had hitherto been good. There are many instances of clerks and others being dismissed for a first offence.

LIGHTING OF THE NATURAL HISTORY MUSEUM.

On the report of the votes passed in Committee of Supply,

Sir G. **CAMPBELL**, on the vote for the British Museum, asked whether arrangements could not be made for the lighting of the Natural History Museum, so that it could be used in the evening.

Mr. **JACKSON** said that, as the introduction of the electric light was a matter of experiment, it had been thought advisable to begin with the British Museum, because it was nearer to the masses of the people, and was more easily reached by them than was the Natural History Museum. The same pressure had not as yet been put upon the trustees to light the Natural History Museum, but experiments would be made with a view to the illumination of the building, should it ultimately be determined upon.

SUBSIDIES TO TELEGRAPH COMPANIES.

On the report of the vote for subsidies to telegraph companies,

Dr. **CAMERON** moved the reduction of the vote by £6,075, being the amount of the subsidy to the Halifax and Bermuda Telegraph Company. He remarked that the circumstances attending the laying of this cable bore a most suspicious resemblance to an unbusinesslike job. The telegraph line from Halifax to Bermuda was one chiefly of strategic importance In 1886 tenders were invited, and the lowest was that of the International Cable Company, which offered to do the work for a subsidy of £8,000 a year for 20 years. That was considered excessive, and in 1888 fresh tenders were invited and three were sent in, the same company being again lowest, with an offer to do it for a subsidy of £6,923 a year for 20 years. That offer was accepted, but subsequently the company was allowed to withdraw it on account of a rise in the material, presumably owing to the corner in copper. Tenders were again invited, and the International Cable Company was again the lowest, and was accepted at a subsidy of £8,100 for 20 years, but before the contract had been ratified the price of copper had collapsed, and, in addition, it must be remembered that a lower tender had been refused in 1886, on the ground that it was excessive. Again, the condition that £100,000 should be subscribed and fully paid up had not been insisted upon, although it was in the Treasury minute.

The Halifax and Bermuda Telegraph Company had its articles of association subscribed by one merchant, one accountant, one agent, and four clerks. The nominal capital amounted to £50,000, but according to information which came to Somerset House, only £35 had been subscribed by the gentlemen named in the articles. He would like to ask the right hon. gentleman what amount of subscribed capital this company had. The prospectus of the company involved statements which might probably prove to be extremely misleading about a subsidy from Her Majesty's Government. In his opinion, the Government ought to have warned the public against the statements contained in the prospectus. The company having been inaugurated, was, to a certain extent, connected with Her Majesty's Government, and they were responsible for it, because, under the contract, they nominated one member of the board, and consequently had a right to all the information about the company. He asked the secretary to the Treasury to state what was the amount of capital subscribed to this company on the 12th of April; what was the date on which he agreed formally to transfer the contract to them, and what amount of capital was subscribed at that date, independently of the debentures on which they got the country to subscribe money on grossly false pretences. He had brought this matter forward for two reasons. In the first place, it involved a gross infraction of the control of that House over contracts submitted to it for ratification; secondly, because of the peculiarities of the whole transaction from beginning to end.

Mr. **JACKSON** observed that he had already given a full explanation of the facts of the case, and went on to say that many questions had been asked which he was, of course, unable to answer. He must decline altogether, on the part of the Government, to accept responsibilty for any statements which might be published in a prospectus. The whole question lay in a nutshell The Government had taken a new departure with the object of securing the laying of the cable. The security was provided, the capital was subscribed, and the cable was to-day in working order. He thought the Treasury were to be congratulated on the economical manner in which they had carried out the undertaking.

Dr. **CAMERON** insisted upon a division, when 37 voted for the reduction of the vote and 23 against it.

The vote was then agreed to.

TELEGRAPHISTS.

In the House of Commons on Saturday, in answer to Mr. P. O'Brien, Sir H. **MAXWELL** said :—The scale introduced on July 11th last fixed the wages of second-class telegraphists at 12s. a week for the first year, at 14s. a week for the second year, and 18s. a week for the third year, thereafter rising by 2s. annually to 40s. a week. This scale is on the whole better, far better, than the one it superseded. In connection with the old scale, however, there was an arrangement under which a learner, if fully qualified, could receive 16s. on appointment, and it is being considered whether a similar advantage should not be given to those learners whose employment began before the new scale was introduced.

TELEGRAPH RATES TO AUSTRALIA.

Mr. **HENNIKER HEATON** asked the Chancellor of the Exchequer whether he was aware that the Australian Governments had contributed a sum of £32,000 a year for the past eleven years to the Eastern Telegraph Company for maintaining and cheapening telegraph communication between Australia and Europe; whether the British Government contributed any portion of the subsidy; whether an application was made this year by the Agents-General of the New South Wales, the Victorian, and the South Australian Governments to the British Government to join in a guarantee against loss, on condition that the telegraph companies reduced the rates to and from Australia from 9s. 4d. to 4s. per word for ordinary messages, and from 7s. 5d. to 2s. 6d. per word for Government messages, and what answer, if any, was given to the Australian Governments.

THE CHANCELLOR OF THE EXCHEQUER: I understand that the subsidy in question was granted mainly with a view to the duplication of the cables between Java and Australia. The British Government did not contribute to the subsidy. An application to the effect indicated in the third paragraph of the hon. member's question was made, but Her Majesty's Government was unable to accede to it.

NEW PATENTS—1890.

12171. "Improvements in electric motor mechanism." S. E MOWER. Dated August 5. (*Complete.*)

12221 "An improved apparatus for the measurement of electrical energy." H. H. LAKE. (Communicated by E. Weston, United States.) Dated August 5. (*Complete.*)

12228. "Improvements in commutators for dynamo-electric machines." J. W. EASTON. Dated August 5. (*Complete.*)

12231. "Commutators for electrical machines." W. W. VAIL. Dated August 5. (*Complete.*)

12244. "Improvements in sockets for electric lamps." A. V. NEWTON. (Communicated by A. Swan, United States.) Dated August 5.

12247. "Improvements in and relating to electric lamps or lighting apparatus." H. H. LAKE. (Communicated by G. C. Pyle, United States.) Dated August 5. (*Complete.*)

12337. "The indestructible electric filament used for incandescent electric light." C. HERZOG. Dated August 7.

12352. "Making electric contacts for ringing electric bells, and other purposes." A. H. BAGNOLD. Dated August 7.

12394. "Composition brushes for electric lighting." W. P. ODLUM. Dated August 8.

12422. "An electric pendulum for firing ships' guns." J. JENC. Dated August 8. (*Complete.*)

12439. "Improvements in and relating to electric lamps or lighting apparatus." A. L. SHEPARD. Dated August 8.

12440. "Portable combination electrical testing set." A. A. DAY and H. J. DOWSING. Dated August 8.

12504. "Improvements in holders for incandescent electric lamps." E. P. ALLAM. Dated August 9.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1889.

6458. "Method of regulating the electric current produced by electric generators driven by a motor having an irregular or variable speed." P. HOHO. Dated April 15. 1s. 1d. The object of the invention is to produce a current of a pre-determined strength, either constant or variable in a predetermined manner, in an electric machine, the speed of which varies within certain limits, by operating on the intensity of the field magnets. 5 claims.

9258. "Improvements in electric signal lamps and appliances connected therewith." F. L. RAWSON and W. S. RAWSON. Dated June 4. 8d. Surrounding the lamp are a number of blinds or shutters which may revolve on vertical pins and be actuated by a wheel or similar mechanism which by its motion engages with each shutter, and causes them to turn through about 90°. The motion of this wheel can be produced by the movement of an armature, due to the magnetic attraction of an electro-magnet. The passage of a current through the electro-magnet causes the armature to move and carry with it the wheel against the force of a coiled spring. By this action the shutters may be opened or shut. On the cessation of the current the spring carries the wheel back to its original position, and the shutters are shut or opened by the wheel. By opening and closing the shutters flashes of light are seen round in all directions, and so can be used for signalling purposes. 6 claims.

10695. "Improvements in electric batteries." H. H. LAKE. (Communicated from abroad by C. A. Hussey and E. H. Brown, both of New York.) Dated July 2. 8d. Consists in the combination in a battery of a porous diaphragm for separating the two fluids, and extending solely in a horizontal or approximately horizontal plane. 4 claims.

10696. "Improvements in electric batteries." H. H. LAKE. (Communicated from abroad by C. A. Hussey and E. H. Brown, both of New York.) Dated July 2. 8d. Consists in the combination in a battery with a cell and negative and positive elements of a porous diaphragm arranged in the upper part of the cell below the positive element, and a piece of metal which is located below the porous diaphragm, and is of such character that it will decompose the salt of copper solution. 3 claims.

10878. "Improvements relating to electric telephones." D. B. MORISON. Dated July 5. 11d. The receiver and transmitter are mounted upon the extremities of a bent rod or of a bent tube through which are passed the conductors for one or the other of the said instruments, a part of the said rod or tube forming a handle, or being provided with a suitable handle of porcelain, wood or other suitable material. The conductors for both the transmitter and the receiver preferably extend through the casing of one or the other of the said instruments, and are connected with terminals attached to a suitable base or stand. The said tube is sometimes made telescopic or otherwise adjustable so that the relative positions of the two instruments can be varied. Another feature of the invention is the provision of a support for the said transmitter and receiver, which is so constructed and arranged that the weight of the combined instruments, when placed on the said support, will cause the interruption of the telephone circuit and switch in the signal or call-bell, suitable provision being made for automatically interrupting the signal or call-bell circuit and switching in the telephonic instruments when the latter are removed from the said support. 4 claims.

10940. "Improvements in electrical couplings used in electrically lighting railway trains, and for other purposes." F. T. HOLLINS. Dated July 8. 8d. The object of this invention, whilst still leaving this contact-piece or circuit closing device, perfectly automatic in its action when the couplings are taken apart, under ordinary circumstances is to provide that when the electric half-coupling at the slipping end of a slip coach is pulled apart from any other half coupling it shall, in coming apart, leave the contact-piece in the half coupling attached to the main portion of the train out of contact with the lamp circuit or lamp and battery circuit. 4 claims.

11179. "An electric meter." SIEMENS BROTHERS AND COMPANY. (Communicated from abroad by the firm of Siemens and Halske, of Berlin.) Dated July 11. 8d. This invention relates to an electric meter, wherein a counter registers the number of oscillations of a bar of soft iron subject to the influence of the electrical current to be measured or of a known fraction thereof. 3 claims.

11191. "Improvements in roses for supporting electric lamps." W. A. S. BENSON. Dated July 11. 6d. The inventor connects the projecting ends of the leads in the wall or ceiling to contact makers, carried by a rosette of wood or other material fixed to the wall, like the rosette used for a gas bracket. The ends of the wires of the fittings are attached to spring contact makers, which are carried by a disc or cone similar to that used for gas brackets and called the "back." It is furnished with screw holes, so that it can be attached by screws to the rosette, as is done in fixing a gas bracket. 3 claims.

11528. "Improvements in electrode plates for electric accumulators." C. BEYER and G. HAGEN. Dated July 19. 8d. Relates to electrodes formed of a skeleton, which serves for the reception of the filling or active material, and which comprises two plates constructed in the form of openwork frames, nets, or gratings, that are connected by numerous cross-pieces, and are surrounded by a solid frame or border. 2 claims.

12444. "Improvements in switchboards for telephone systems." J. R. SMITH. Dated August 6. 8d. The object of the invention is to provide a switchboard specially adapted for telephone systems, which will enable any subscriber to make a direct connection with any other subscriber in the system without the intervention of a third party at a central office. 7 claims.

CORRESPONDENCE.

Cable Testing.

My attention has been drawn to a paragraph in the ELECTRICAL REVIEW for the 18th ult., to which absence from England has prevented me from replying earlier.

The paragraph in question is intended as a criticism on an article on cable-testing, which I published in *The Electrician* for the 11th ult., and is of so weak and puerile a nature, that I should have refrained from commenting upon it, had I not felt that my silence, instead of being attributed to contempt for such unscientific criticism, might possibly, by some persons, have been construed into inability to reply to the attack.

I cannot boast myself a regular reader of the ELECTRICAL REVIEW, but, if I ever chance to take up a copy of this paper, I am always reminded of the tale of the Staffordshire miners, who are reported to greet the appearance of a stranger by "'eaving 'arf a brick at 'is 'ed." Whenever anything is done in connection with electrical engineering which is beyond the somewhat limited experience of the editors of the ELECTRICAL REVIEW, they do not fail to 'eave the 'arf brick at the 'ed of the electrical stranger, although in their hands it is neither so efficient nor so weighty a weapon as in the hands of the Staffordshire miner; and, instead of annihilating the "stranger," not infrequently recoils on the assailant.

But I must remind the writer, or writers, of the paragraph to which I am referring, that assertion is not argument, nor inaccurate statement, proof. If the method which I have described be so ancient a one it is a somewhat curious fact that it is not described in any of the numerous text-books devoted to cable testing, and it is a still more curious fact that telegraph engineers of large experience and considerable knowledge of cable testing should be admittedly ignorant of this "so simply obvious" (*sic*) a method.

I therefore challenge the ELECTRICAL REVIEW to justify the gaseous effusion which appeared in their publication for July 18th, by giving chapter and verse for their statements, that the method described is neither novel nor interesting, or to acknowledge that they now, as so frequently before, have written at random.

H. Cuthbert Hall.

In response to our request that independent testimony to the correctness of our statement should be given, we have received the following communications from a number of gentlemen to whom we tender our cordial thanks.—EDS. ELEC. REV.:—

Mr. E. MARCH WEBB, electrician-in-chief to the India Rubber and Gutta Percha Company, Silvertown, says:—

"The system is as old as described. The particular method of application may vary according to individual idea. It is well known, in one shape or another, to every electrician."

To Mr. Webb's communication we append another from a gentleman with whose text-book Mr. Hall may possibly be acquainted:—

"It is evident that Mr. Cuthbert Hall can have had no experience whatever of cable factories, or he would not have made such an exceedingly absurd claim of originality for the method of localising faults in insulated wires which he describes. There is not a cable factory in existence, I believe, where the method described, and modifications of it, have not been, at some period or other, in almost daily use; this I can testify as the result of 20 years' experience. It may be that the method is not specifically described in any text book, but the reason of this is that it is so obvious as not to require description. I may add that the method is in daily operation at the Gloucester Road factory of the Postal Telegraph Department, and has been so ever since insulated wire has been in use. Mr. Hall's remarks relative to the Editors' limited experience is amusing, seeing that these gentlemen have, with the exception of one firm, probably had a longer and wider experience in the testing of insulated wire for submarine cables and other purposes than anyone in the electrical profession.

"H. R. KEMPE.

"Electricians' Department, General Post Office."

Messrs. WALTER T. GLOVER & CO.'S Electrician informs us that the method of fault testing with revolving drums, described by Mr. H. Cuthbert Hall, has been practised in their works for the past five years.

The MANAGER OF HENLEY'S TELEGRAPH WORKS sends us the following:—Referring to yours of 15th inst. The system mentioned was used by us over 20 years ago, but has been abandoned in favour of a more practical method.

My attention having been called to Mr. Cuthbert Hall's system of testing, and also to a communication from him in reference to it, I would state that the method devised by him, which I have no doubt he thought was original at the time he invented it, is at the least forty years old. The germs, and a good deal more than the germs of this method of testing, were introduced by my brother, the late C. F. Varley, to test defectively insulated wires in railway tunnels, shortly after gutta-percha covered wires replaced suspended ones for tunnel work. The faults were localised in the following way: one end of the gutta-percha covered wire was connected to one pole of, say, 300 cells of a sand battery, the other pole being earthed, a piece of flannel soaked in acid and water was wrapped round the gutta-percha wire and embraced by the fingers of a lineman who walked through the tunnel, passing the flannel tube over the outside of the gutta-percha covering; when the fault was reached, the lineman's fingers and body acted the part of a galvanometer, the current passing through him to the earth and the position of the fault was afterwards more exactly localised by an ordinary lineman's detector.

When gutta-percha insulated wires came into use for underground circuits, the Varley system of testing was further developed by its introducer at the Gloucester Road Telegraph Stores. The coils of insulated wire were wrapped on a drum in a *precisely* similar manner to that described by Mr. Hall, and passed through an insulated trough containing acid and water.

The battery employed was a carefully insulated sulphate battery of seven or eight hundred volts, the troughs being suspended by gutta-percha bands from the roof of the workshop. One pole of the battery was in electrical connection with the copper core of the gutta-percha coated wire, and the other battery pole was connected to one of the two terminals of a very sensitive horizontal astatic galvanometer, made by the late Mr. Henley, and which stood on a strong oak bench, resting on a solid brick foundation, the second terminal of the galvanometer was electrically connected with the trough containing the acidulated water through which the coated wire passed, by being wound on to a second drum.

I shall be well within the mark, I think, if I say hundreds of miles of wire were tested in the manner described, under the direction of the late Mr. Muirhead, who was out-door superintendent of the old Telegraph Company, and who had charge of the workshops and the Store Department at Gloucester Road. I should think it probable that Dr. Alexander Muirhead may remember seeing this system of testing in practical use when he was a schoolboy, seeing that his father lived on the company's premises, at all events, Latimer Clark will be very familiar with the system of testing introduced by my late brother.

I may mention that the late Dr. Wildman Whitehouse reinvented the Varley system, and finding he had been anticipated, he called upon my brother. I was present at the interview, which took place in 1859 or 1860.

Mr. Cuthbert Hall would really appear to labour under the hallucination that the stock in trade of the editorial department of the ELECTRICAL REVIEW includes, among other things, a plentiful supply of "arf bricks"; possibly *his* experience in electrical engineering is "somewhat limited," for were he better posted up, he would be very likely to know that the experience of the editors of the ELECTRICAL REVIEW in matters of testing, more especially in connection with submarine cables, is considerable. If he were to read the ELECTRICAL REVIEW regularly, instead of taking it up *only* occasionally, he might possibly become more charitably minded, and be less disposed than he would now seem to be, to take a leaf out of the book of our very good friends, the Staffordshire miners, and "'eave arf bricks at the 'eds" of the editors.

S. A. Varley.

Another correspondent writes:—"I have gone through Hall's paper in the *Electrician*, and also your leaderette, and I cannot see anything to alter in your remarks. The only fresh point I notice in Hall's paper is the fact that he cuts an aperture in the centre of the drum to admit the end. Now, no one but a tyro would do that. All cable drums and insulated core drums now-a-days have a hole cut at the side or end of the drum, so as to allow of the end, and as much more as may be required to be outside for testing, &c.

"Such a simple matter of testing is not usually described in text books, nor are methods of connecting up, &c.; the original method of fault-finding by passing through an insulated water trough will be found in Culley, and was known to everyone.

"In Kempe's last edition, describing Jacob's method (which, by the way, Hall does not seem to know), p. 438, testing for faults from core and using *two drums* is referred to. The test only is explained, and the simple connections required with a revolving drum are naturally not referred to or explained, they are 'simply obvious' to the meanest understanding. Moving contacts may vary according to one's ideas, but the method of testing described by Hall is ancient.

"I am told that testing has been carried out at Helsby and at Henley's, and also Siemens', with revolving drums. This must be so, especially with Jacob's test. When swift's are used, then connection is made either with a brush on the spindle, or the end is attached to a suspended connector working in a swivel.

"The insulated trough, with metal plate, I have used for this purpose in the long past, and in the present, it has been of the form adopted for testing joints by Clark's method of accumulation. This I found handy for both purposes, and my present one is built on same lines; but I added a slight improvement to my trough (which was insulated at the four corners by telephone knob insulators screwed in). I found my trough (2 feet about) rather short, for minute faults went through sometimes before the water got at them. I accordingly mounted in the centre of the trough a small drum, with a circumference of about 3 feet; two turns round this, and the trough gave me a practical length of 8 to 9 feet, with satisfactory results.

"It is very difficult to give any dates or particulars as to the use of this simple means of fault testing, but the method of testing G.P. wire through water in an insulated trough was employed when I was a boy. The use of a revolving drum *only* introduced a friction contact instead of a fixed one, the method of testing being the same."

Fall of Potential.

"Works Manager" may possibly prefer a rule which avoids reference to a table of resistances and the calculations often needed, and enables him to make use of the 1,000 ampères square inch table he already has. In similar cables the fall of potential varies directly as the length in yards (to and fro) multiplied by the current. In the example given, 200 × 10 : 75 × 15 :: 2·2 : 1·2375. Stated as an equation fall of potential, $e\,c$

$$= \frac{2\cdot2 \times 75 \times 15}{200 \times 10} = 1\cdot2375,$$

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A. Whalley.

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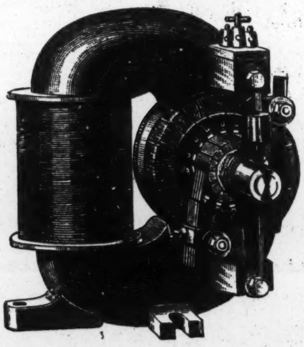

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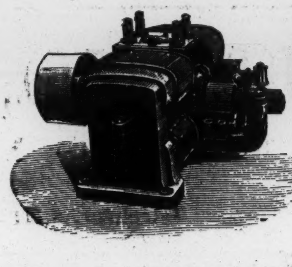

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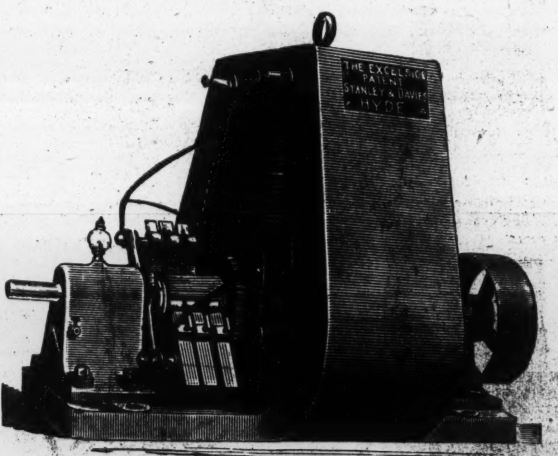

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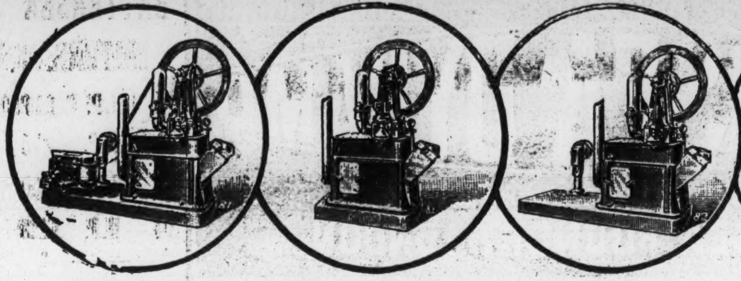

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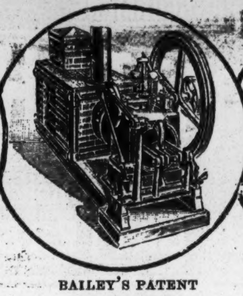

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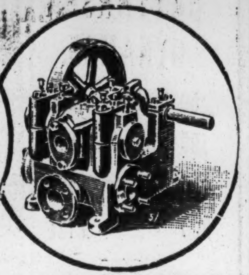

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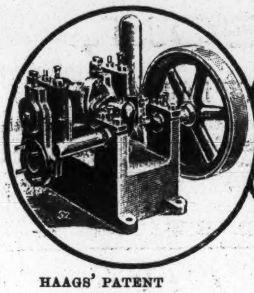

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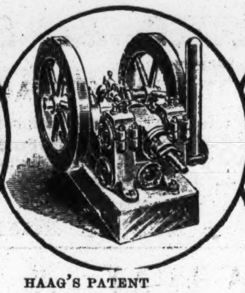

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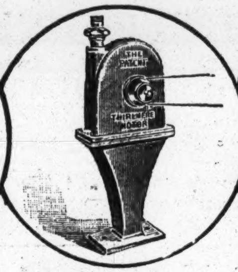

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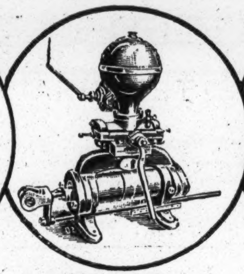

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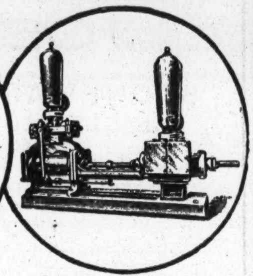

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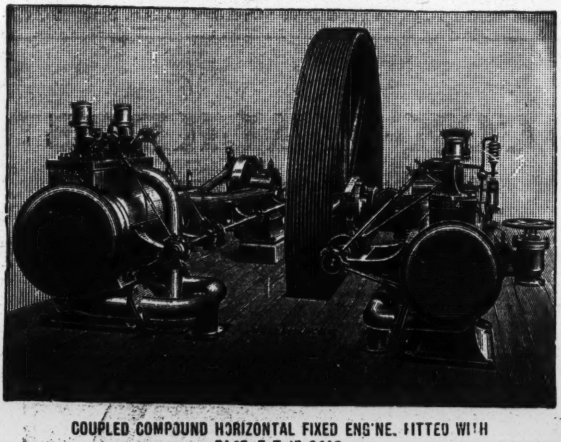

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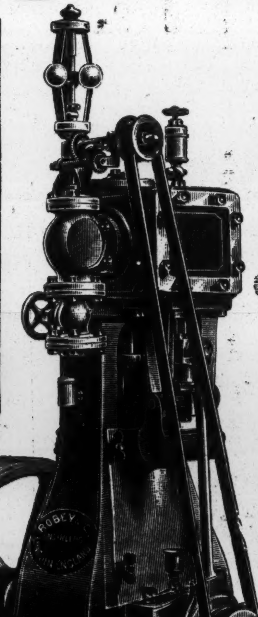

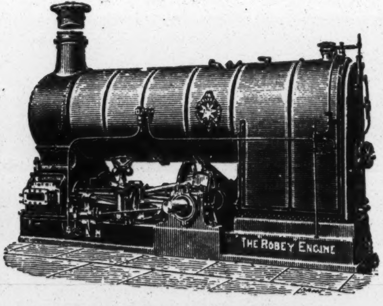

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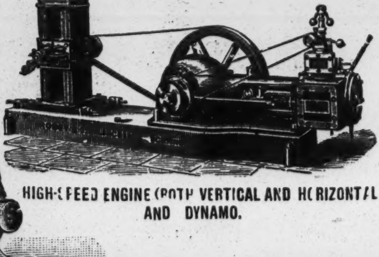

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3254

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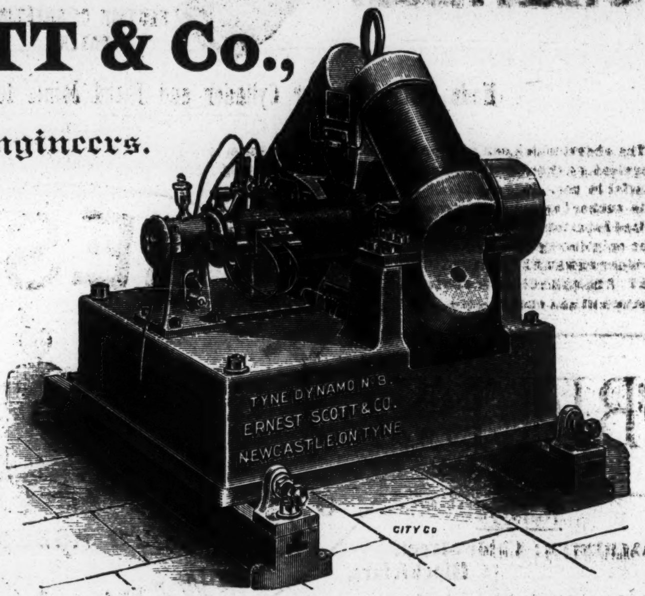
3311



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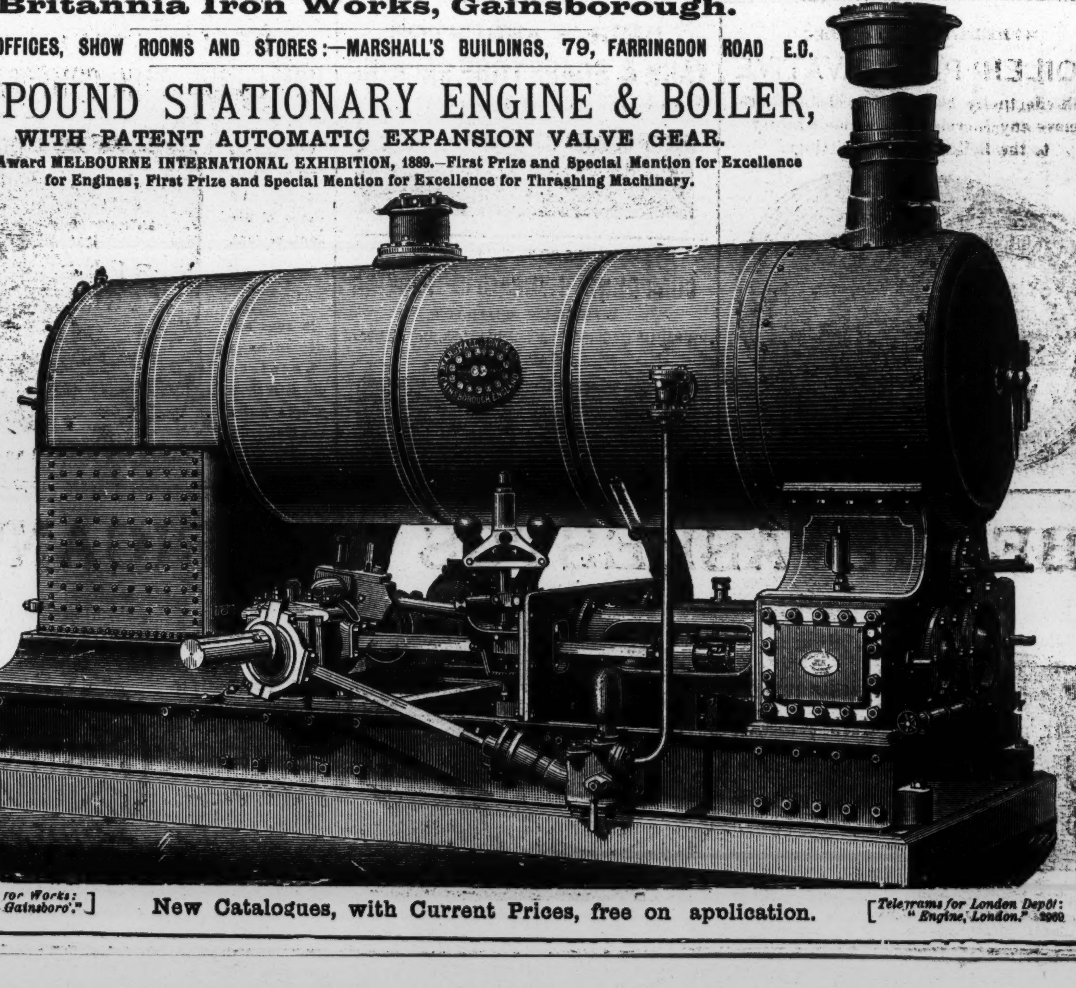

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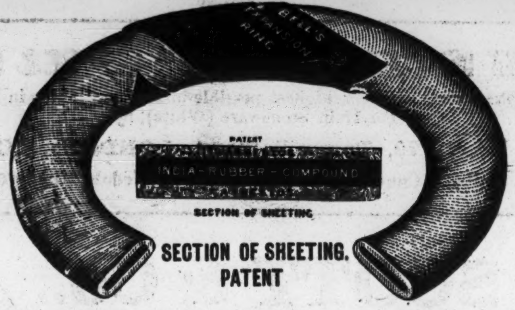

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Made from 1-Ply for Cylinder and Faced Joints to any thickness for uneven surfaces.

The above, which can only be obtained from this house, is recognised as the Most Efficient and Economical Jointing Material in use. It is composed of a specially-prepared India-rubber Compound, protected by a covering of Vulcanised Asbestos Sheeting, as shown above, and as it is the only Jointing Material which adequately combines PERMANENT ELASTICITY WITH HEAT RESISTANCE, the advantages it possesses will at once be seen.

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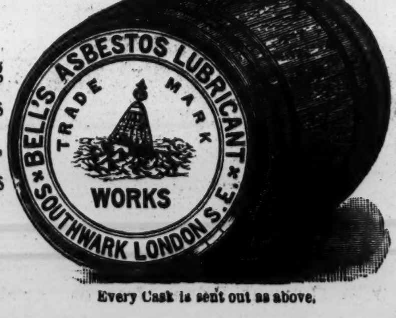
Any customer receiving Oil sold as Bell's Asbestos Lubricant, & Cask, Drum, or Corks not marked as shown, is earnestly requested to forward us sample and particulars of where obtained.



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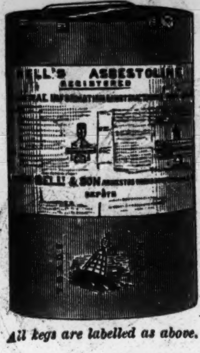

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ASBESTOLINE is the most efficient Lubricant for all bearings.
ASBESTOLINE is the cheapest Lubricant.
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ASBESTOLINE has beaten all other Lubricants in making trials.
ASBESTOLINE is applicable in and out doors in every climate.
ASBESTOLINE requires no special application.

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BELL'S ASBESTOS.

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ASBESTOLINE, to meet all circumstances, is made in four degrees of consistency, A, B, C, and CC.

ASBESTOLINE A, is specially adapted to ordinary Land Engines and Machinery, in and out-door, in this country.

ASBESTOLINE B, a little more solid, is for use on Steamships in temperate climates, also on land when it is desirable to have Lubricant stiffer than A.

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SUPPLIED IN KEGS, 28 lbs., 56 lbs., or 112 lbs.

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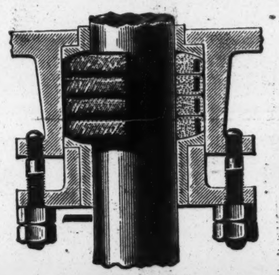

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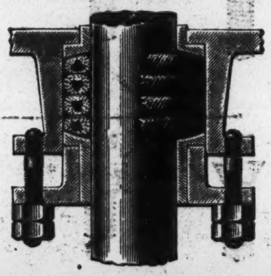
Every 10 feet has label as above, and bears our Trade Mark.



Under this registered title are included the inventions of Mr. Field, and experience has proved them to be **THE MOST EFFICIENT, DURABLE, AND ECONOMICAL PACKINGS** ever made. They constitute such a combination of Asbestos and India-rubber as secures the maximum of elasticity and heat resistance, and they are therefore **UNEQUALLED FOR EVERY KIND OF ENGINE.** These Packings are being universally used by most of the leading Steamship Companies throughout the world for ordinary Compound, Triple, and Quadruple Expansion Engines of the latest type. These Packings are composed of Rolled Asbestos Cloth, but the India-rubber is placed in two forms to suit various cases.

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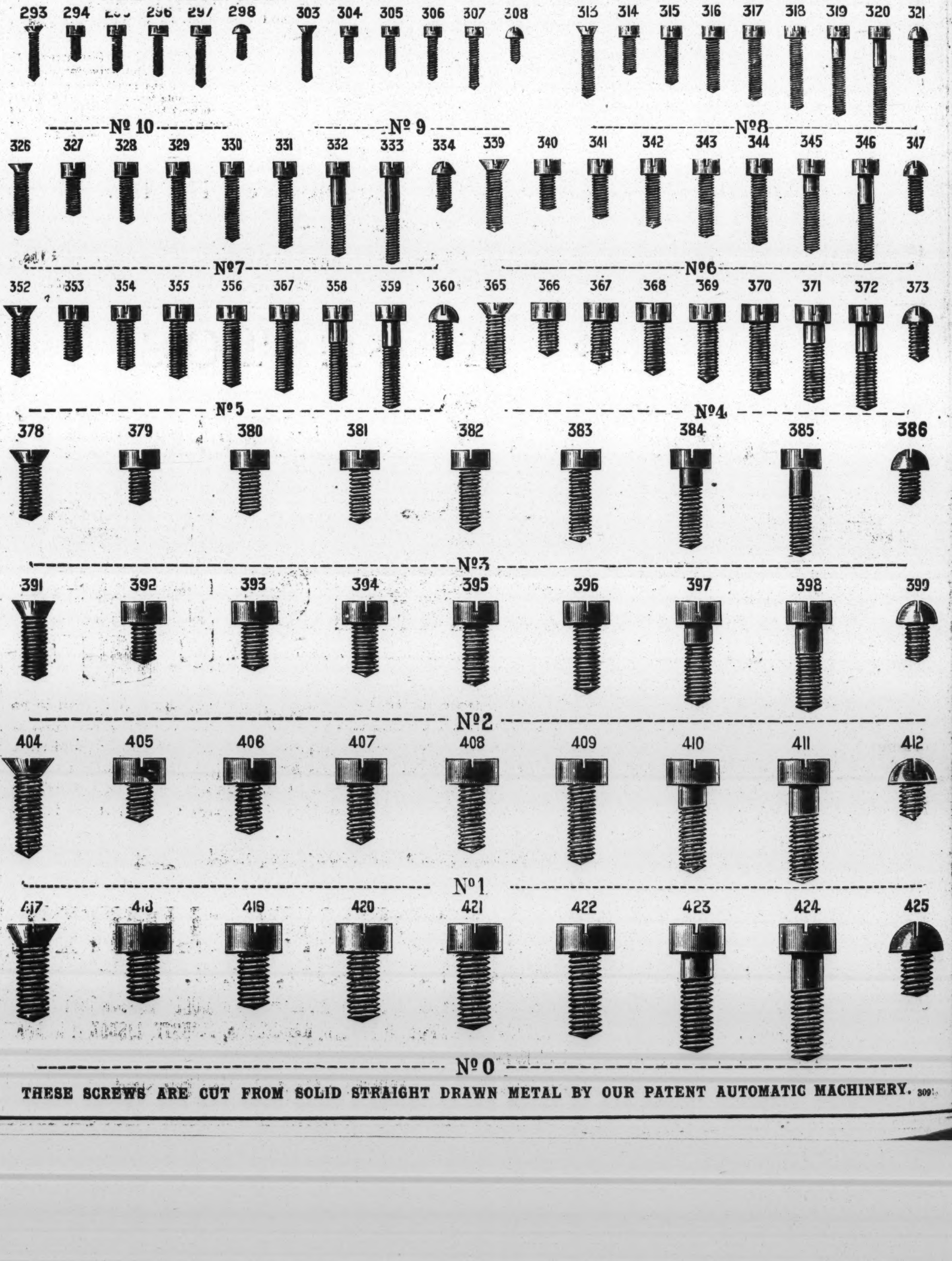

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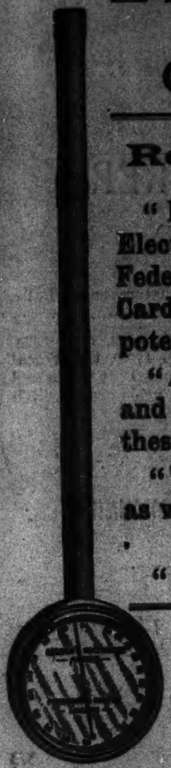

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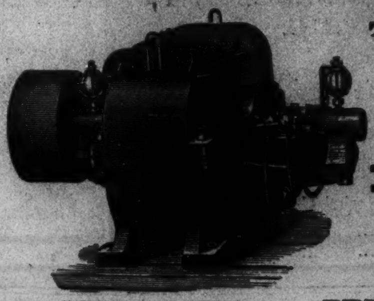

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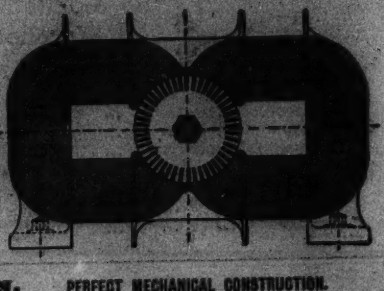

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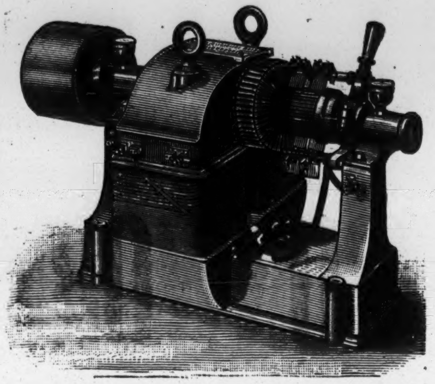

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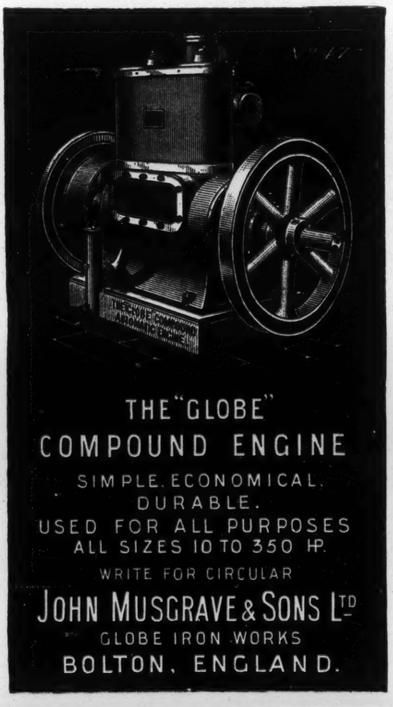

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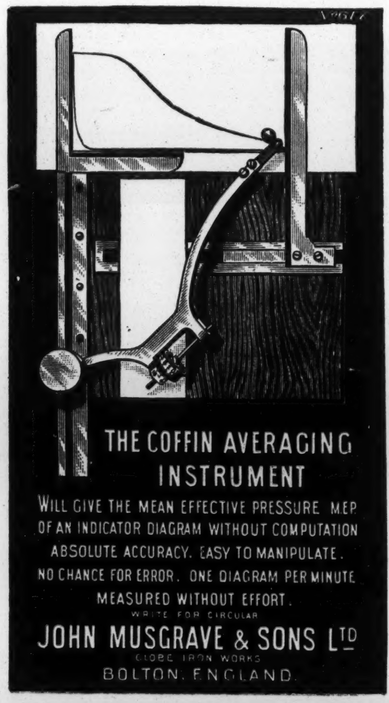

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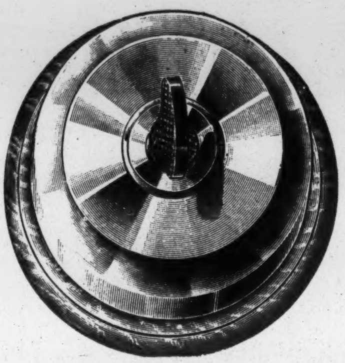

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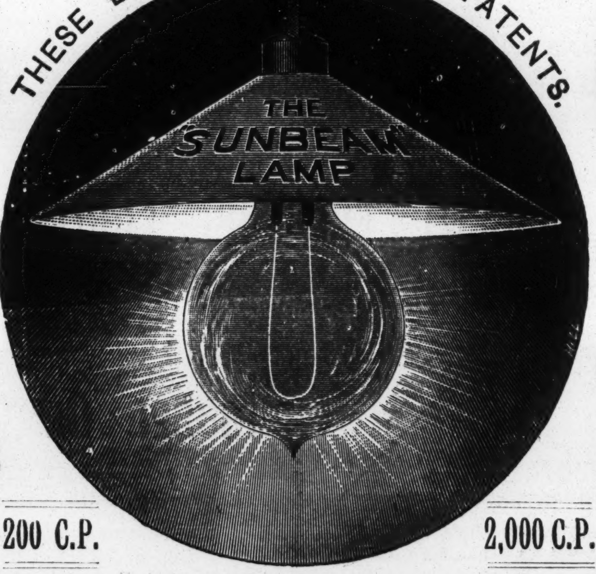

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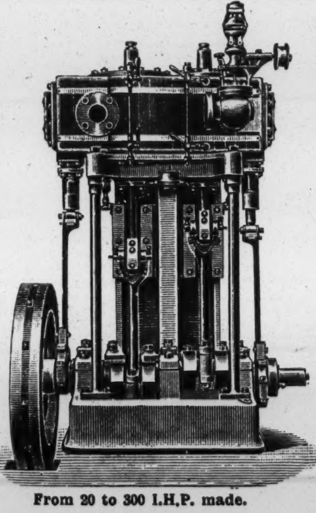

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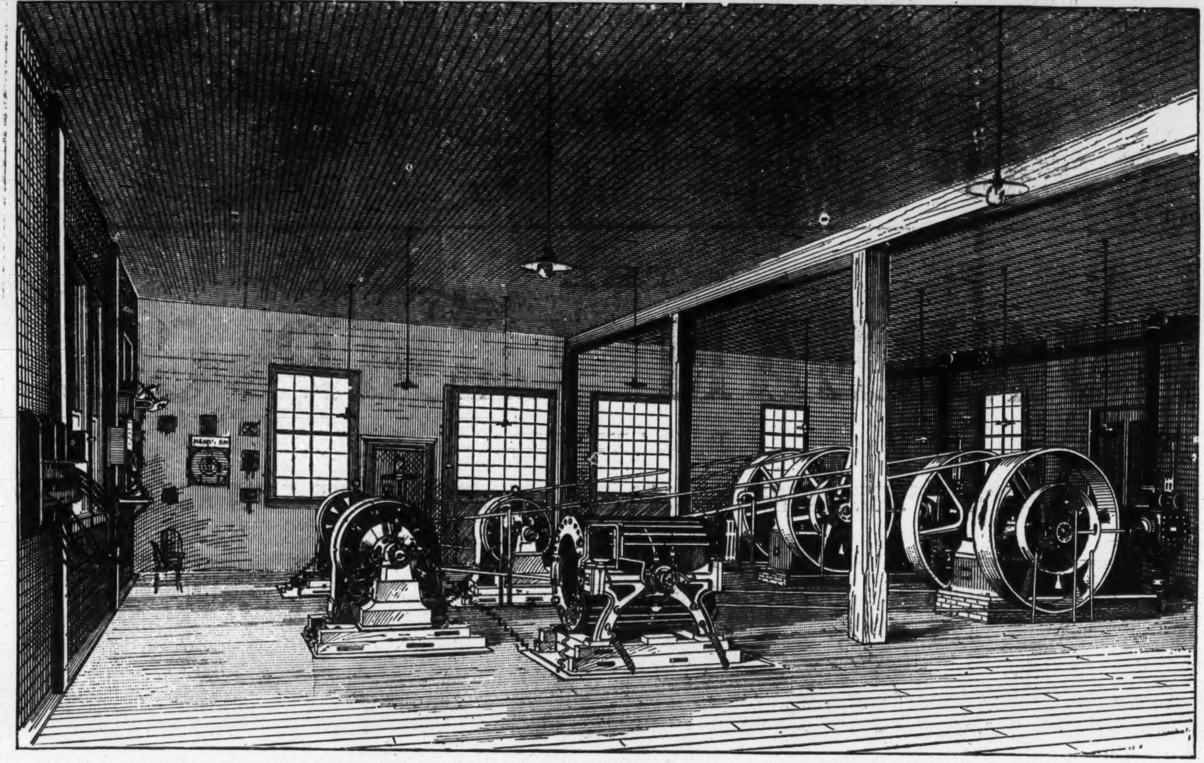

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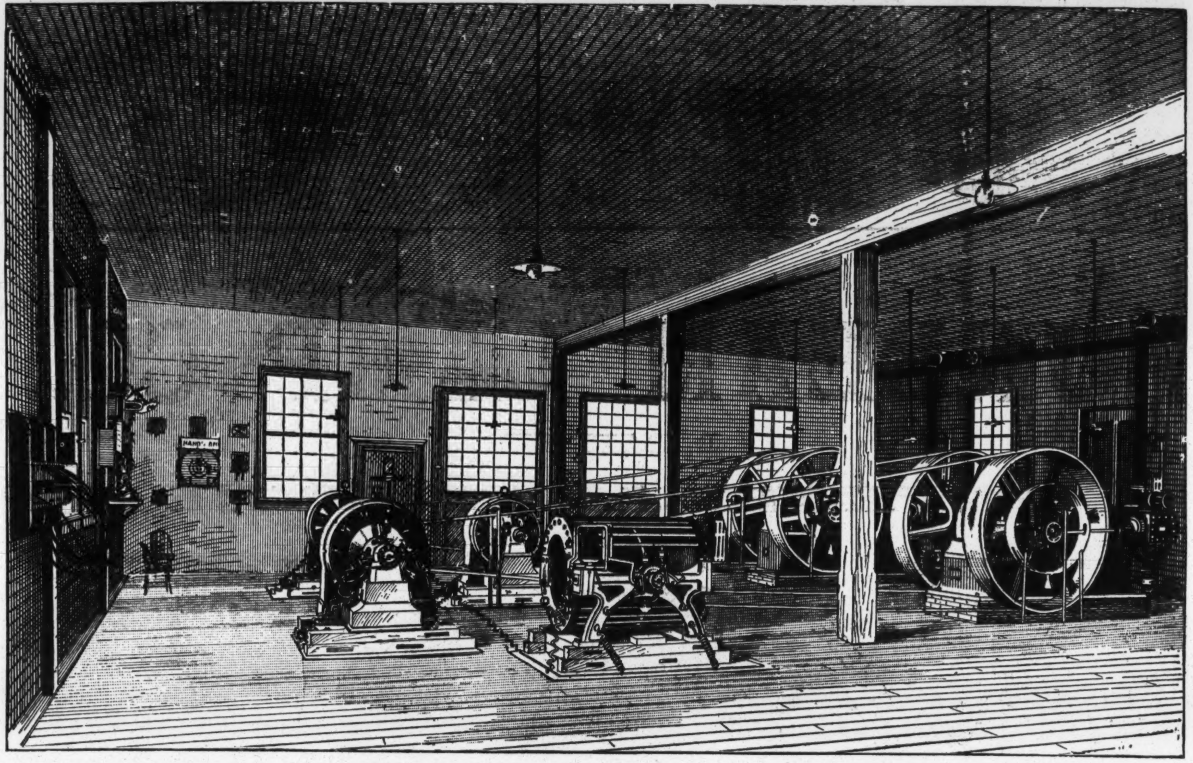

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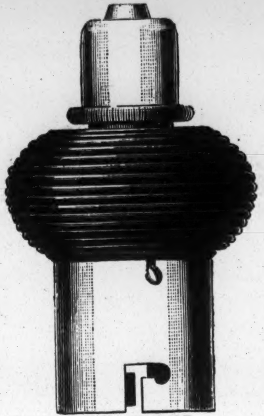

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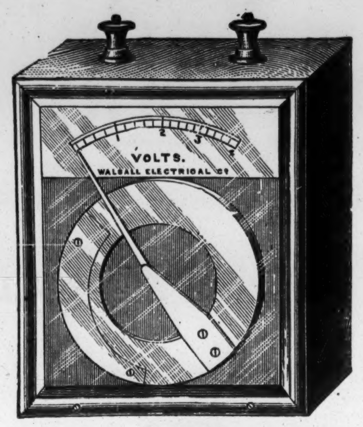

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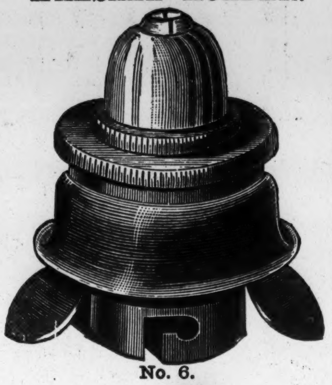

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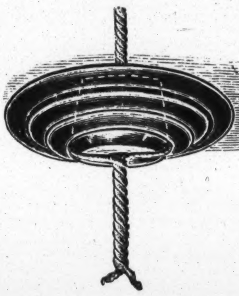

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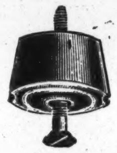

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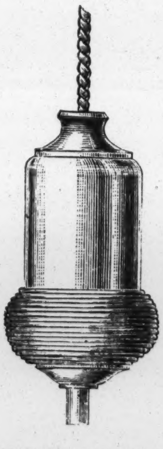

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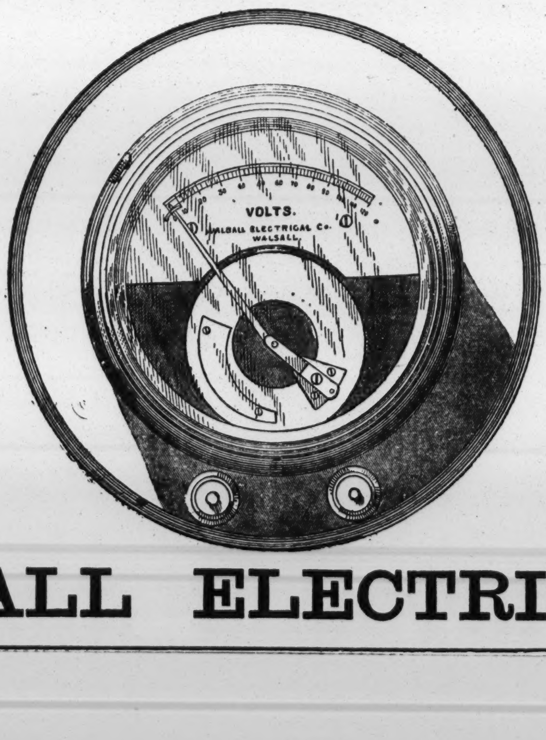

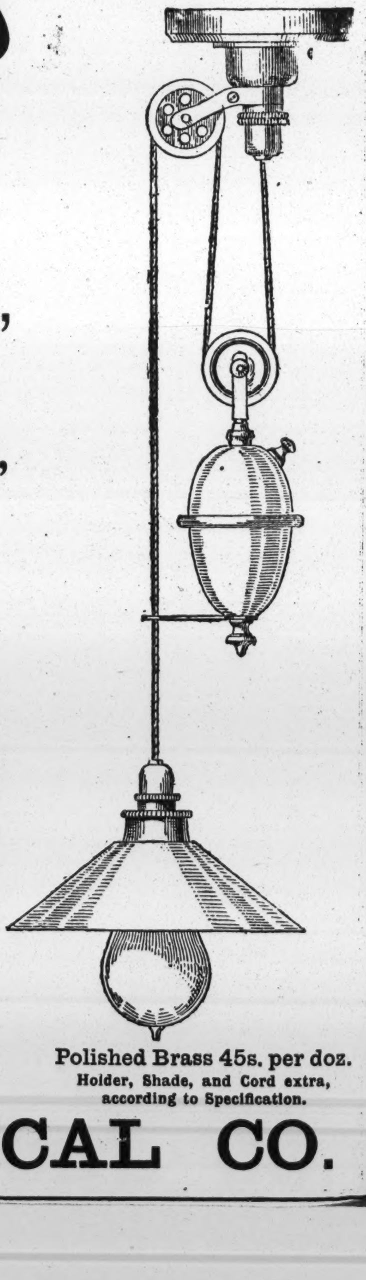

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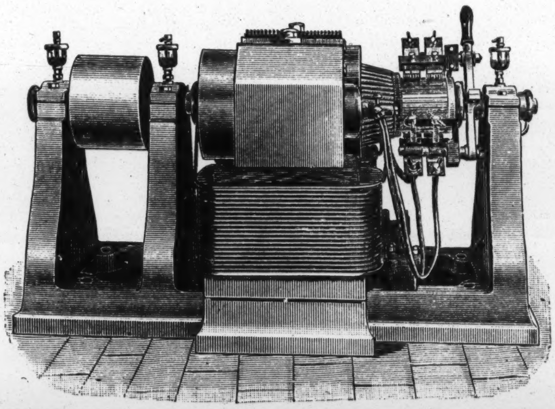

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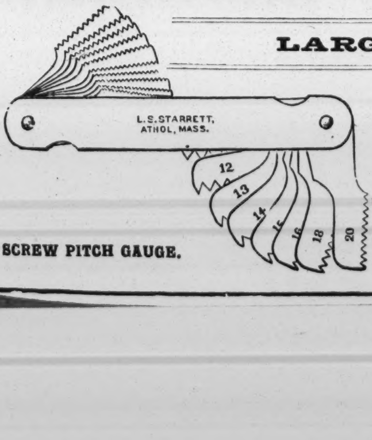

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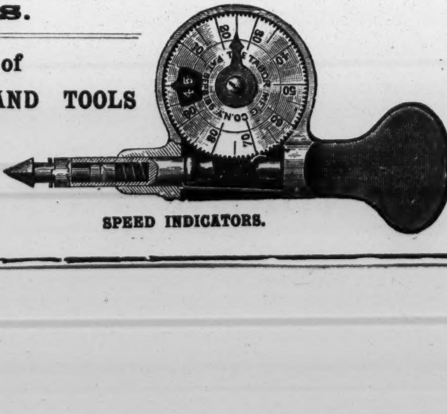

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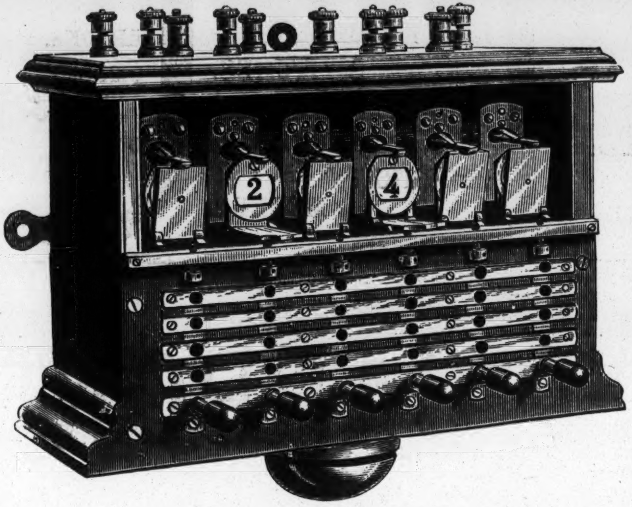

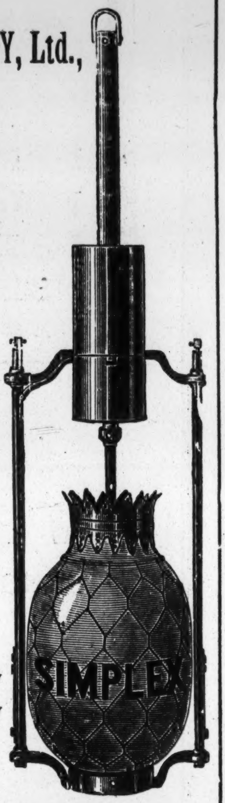

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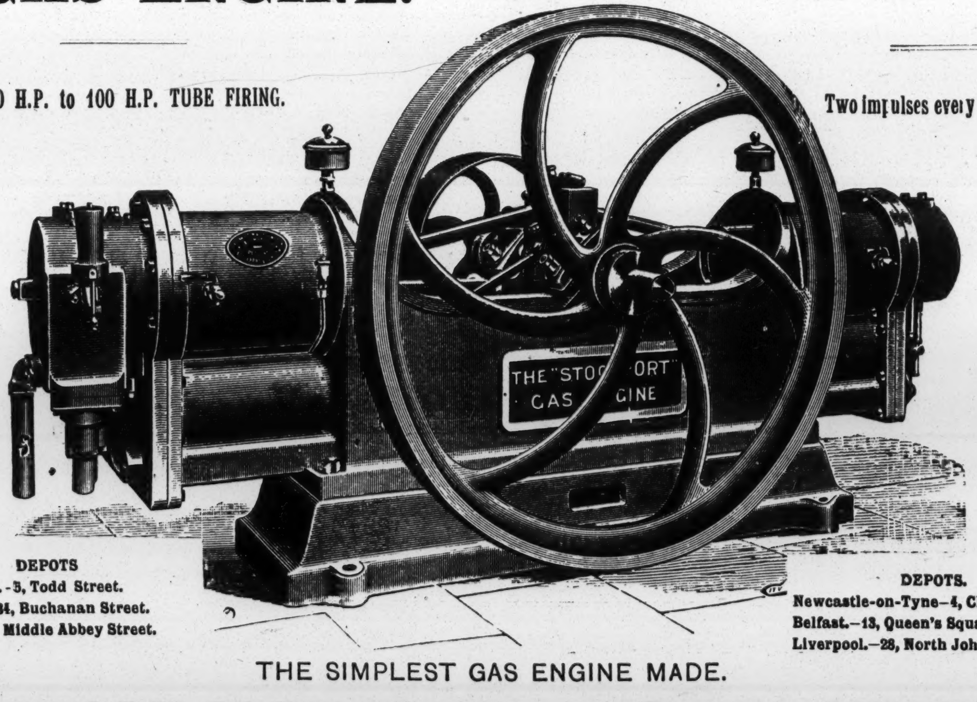

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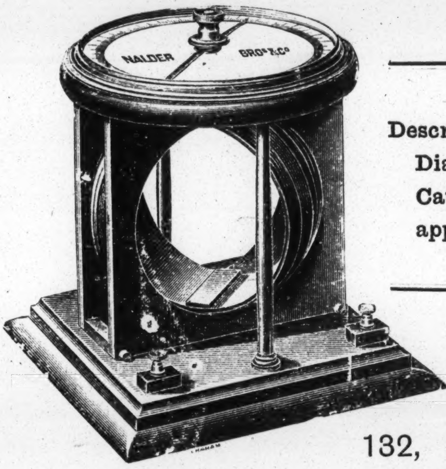

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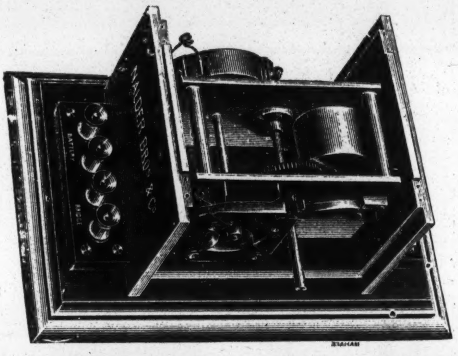

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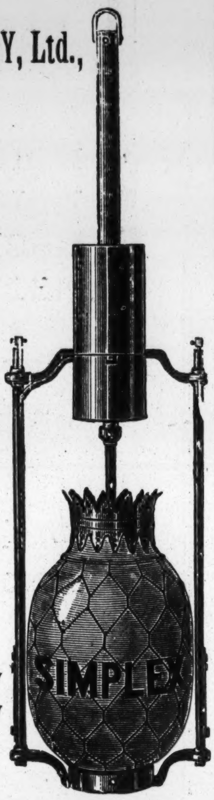

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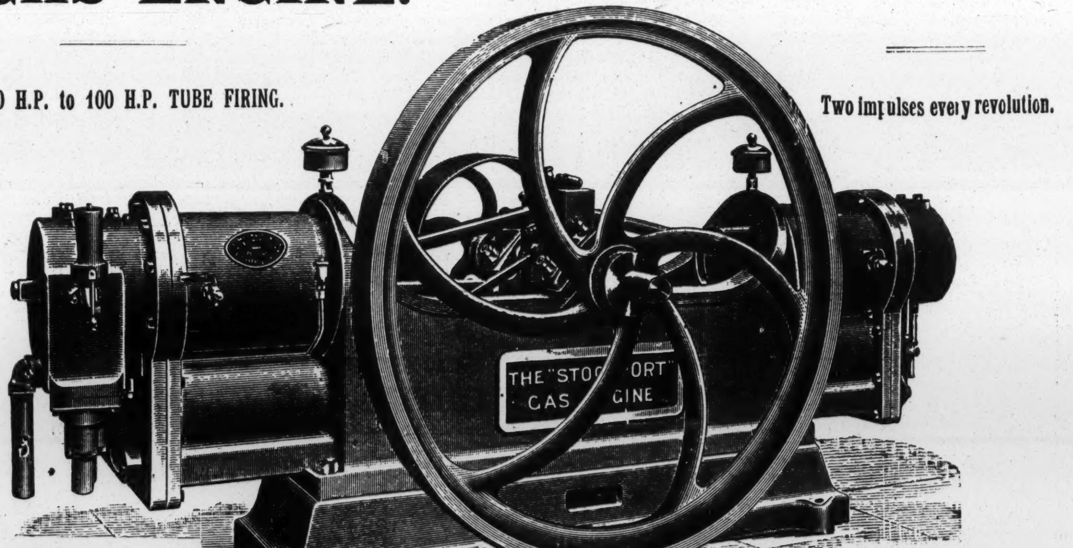

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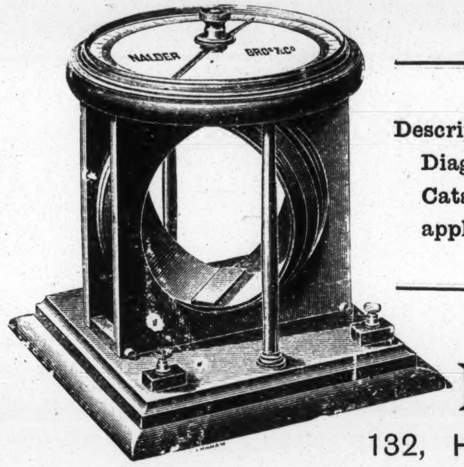

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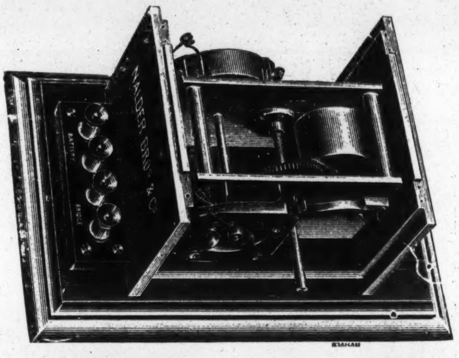

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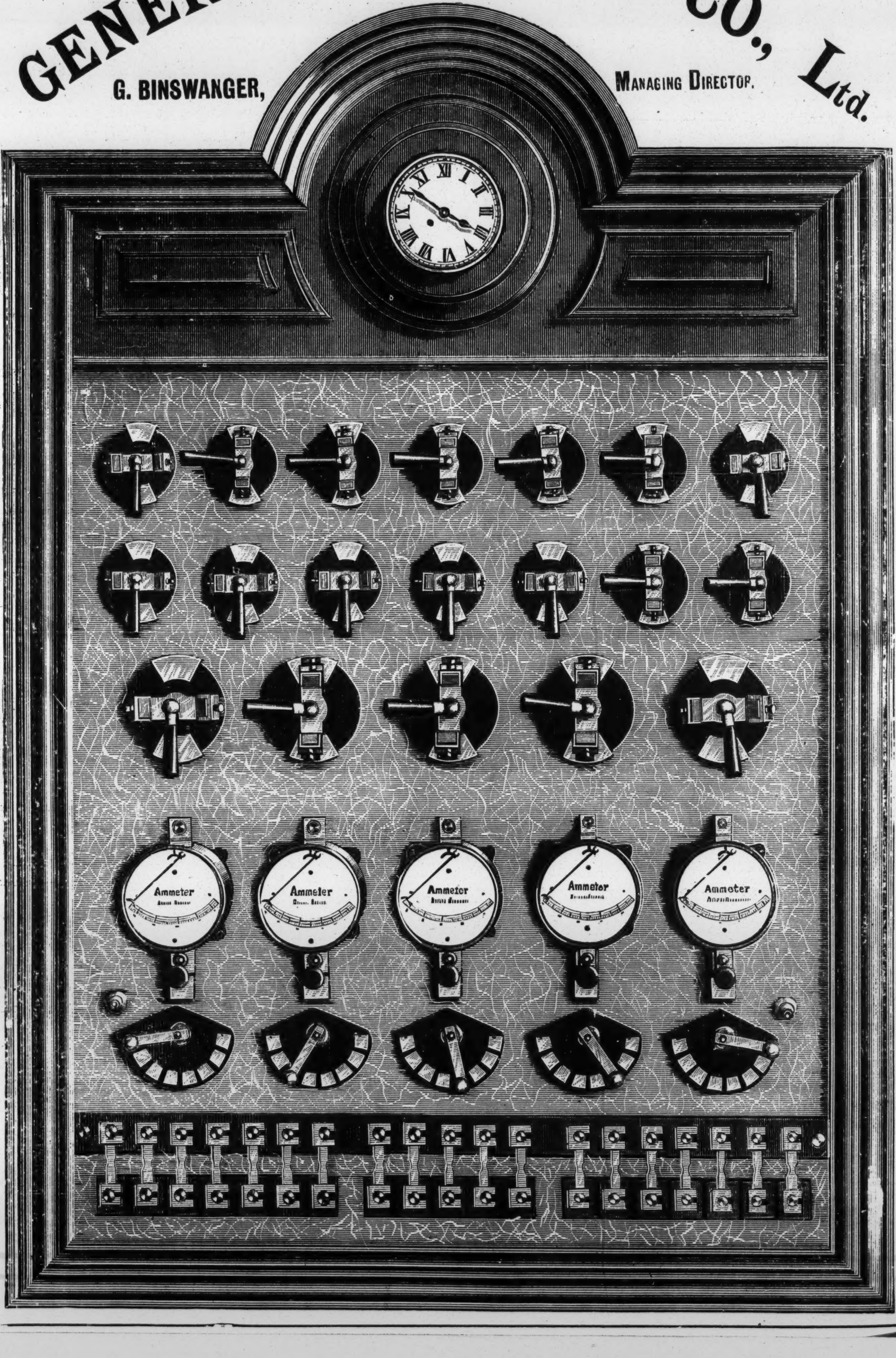

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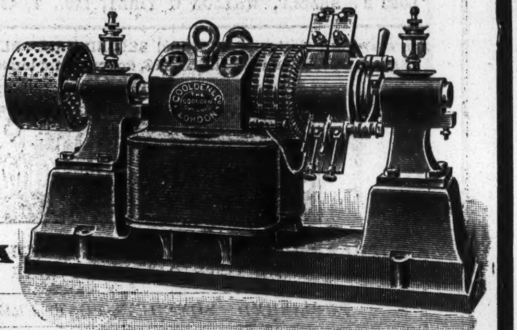

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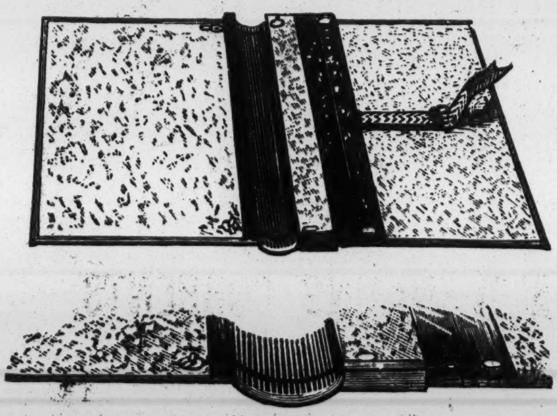

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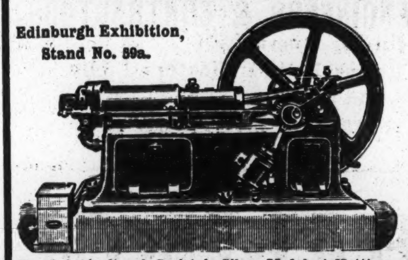

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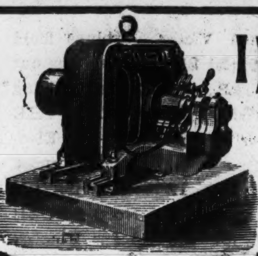

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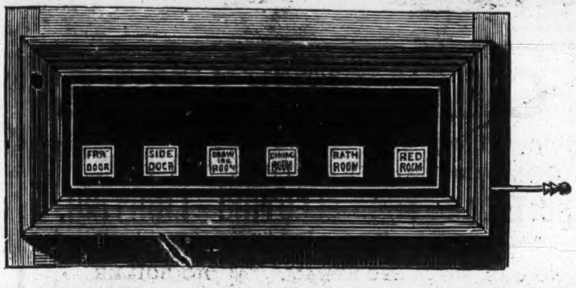

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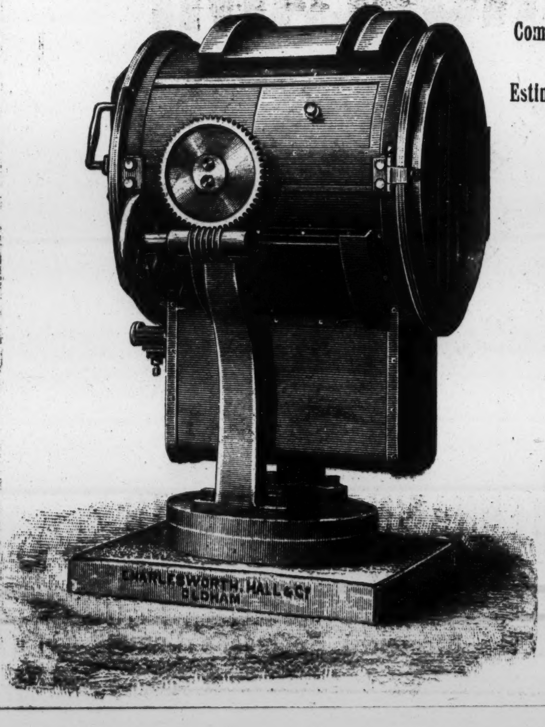

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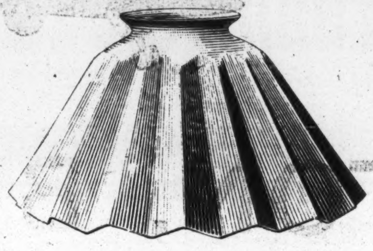

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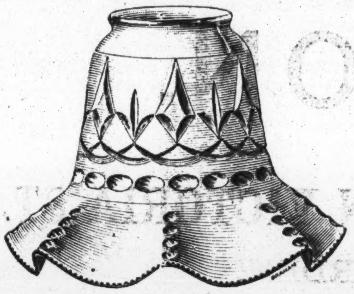

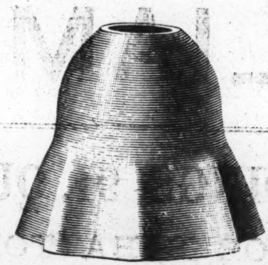

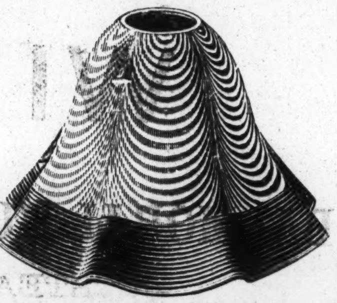

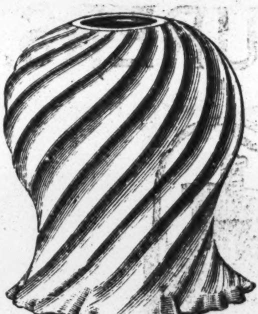

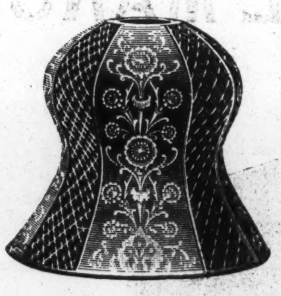

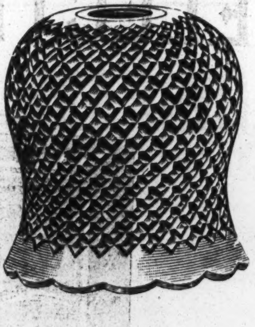

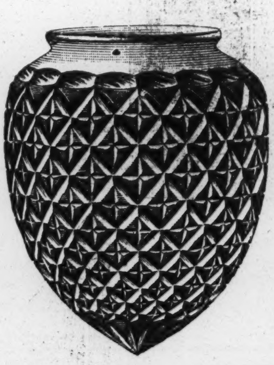

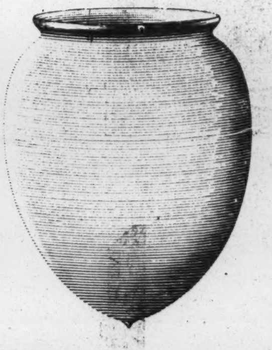

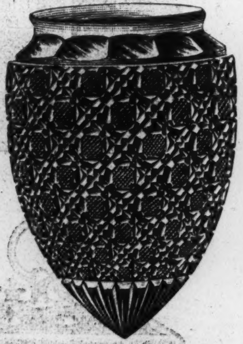

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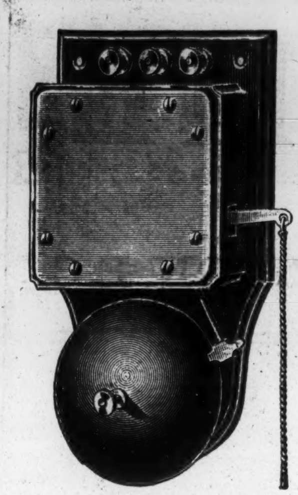

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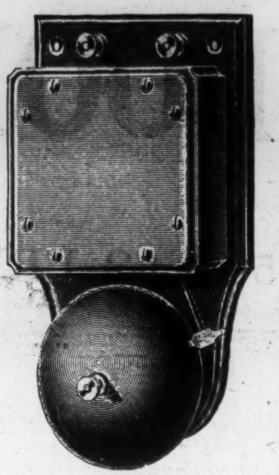

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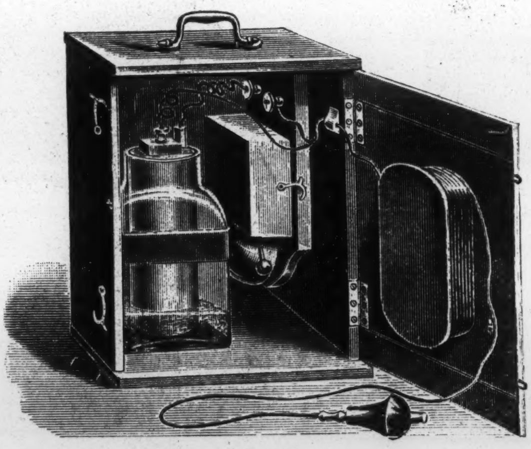

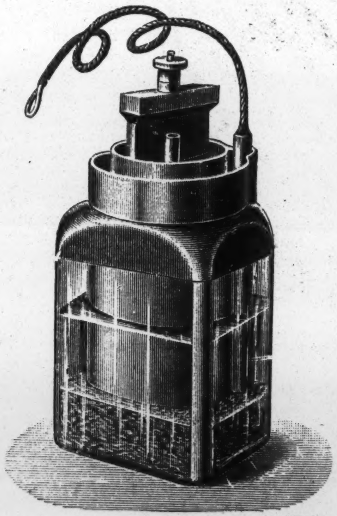

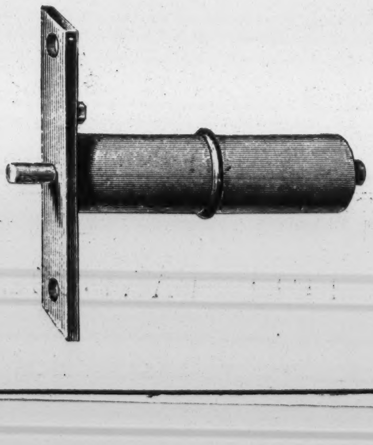

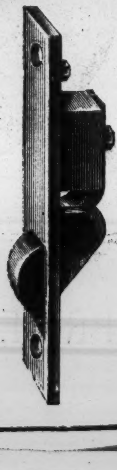

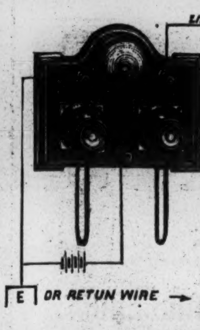

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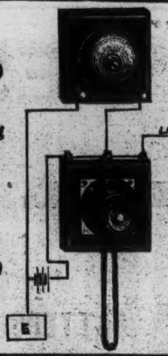

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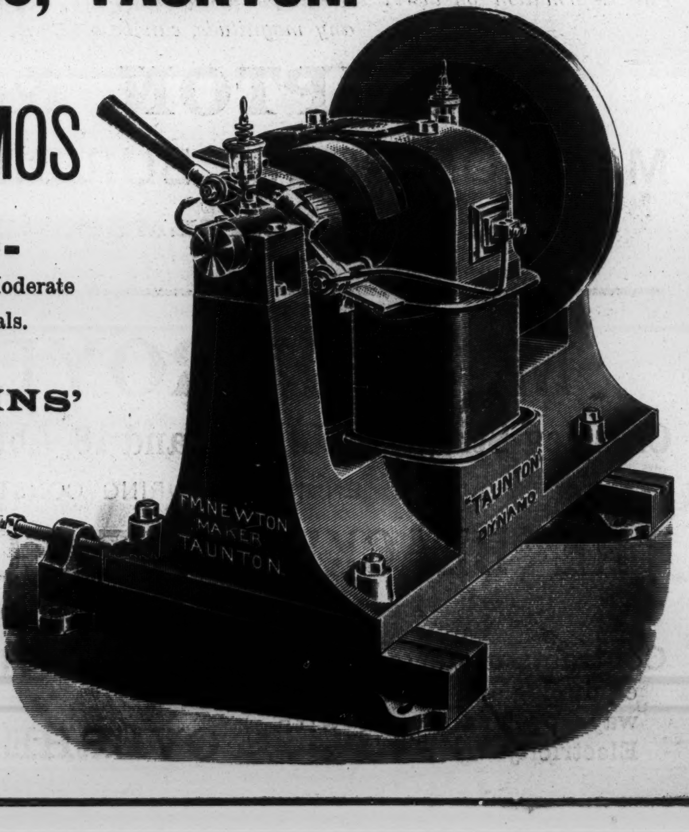

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